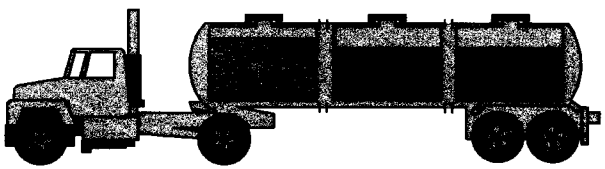
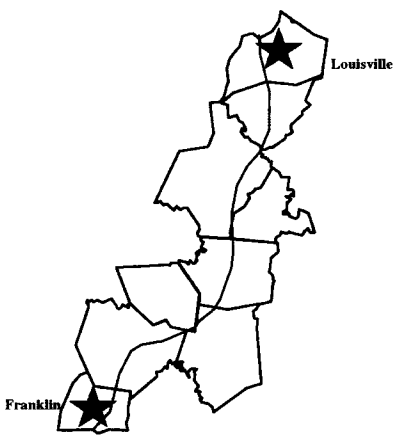
I-65 CORRIDOR COMMODITY FLOW ANALYSIS



FINAL REPORT

September, 1996



Presented to the Kentucky Emergency Response Commission by the Jefferson County Emergency Planning Committee and Morehead State University

THE KENTUCKY I-65 CORRIDOR HAZARDOUS MATERIALS, COMMODITY FLOW ANALYSIS

Presented to:
The Kentucky Emergency Response Commission
October, 1996

Presented by:
The Jefferson County Emergency Planning Committee

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Center for Community and Economic Development
Morehead State University

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THE KENTUCKY I-65 CORRIDOR
HAZARDOUS MATERIALS, COMMODITY FLOW ANALYSIS

Presented to the Kentucky Emergency Response Commission
by the Jefferson County Emergency Planning Committee

CHAPTER ONE
INTRODUCTION

This report presents the results of a hazardous materials, commodity flow analysis for the Kentucky portion of the I-65 corridor conducted by the Center for Community and Economic Development at Morehead State University on behalf of the Jefferson County Emergency Planning Committee. The purposes of the report are to: (a) detail current (1996) patterns of hazardous materials flow by truck within the I-65 corridor, and (b) summarize the recent (5 previous years for which data are complete, 1991-95) history of transportation (truck only) incidents (accidents) involving the release of hazardous materials within the I-65 corridor.

It is hoped that presentation of these hazardous materials movement patterns with statistical and graphical clarity will inform communities along the corridor in ways that will permit planning and preparedness for efficient and effective response to the unintended release of these materials due to incidents involving their transportation through these communities.

The current report is the third in a series of corridor analyses. Previous reports are available for the I-64 and I-75 corridors in Kentucky. These reports are available through the Kentucky Emergency Response Commission.

1.1 Background

The "Superfund Amendments and Reauthorization Act (SARA)" was signed into law in October of 1986. More commonly known as "Title III" or the "Emergency Planning and Community Right-to-Know Act," the elements of this law were explicitly designed to help communities deal safely with the many chemical substances that are stored and transported within the jurisdiction and preparing (planning) accordingly. Subsequently, passage of the Hazardous Materials Transportation Uniform Safety Act of 1990 directs and supports local governments' efforts and capabilities to manage hazardous materials transport emergencies. The fundamental logic underlying the I-65 hazardous material flow study is that a basic inventory of the composition,

THE I-65 CORRIDOR IN KENTUCKY

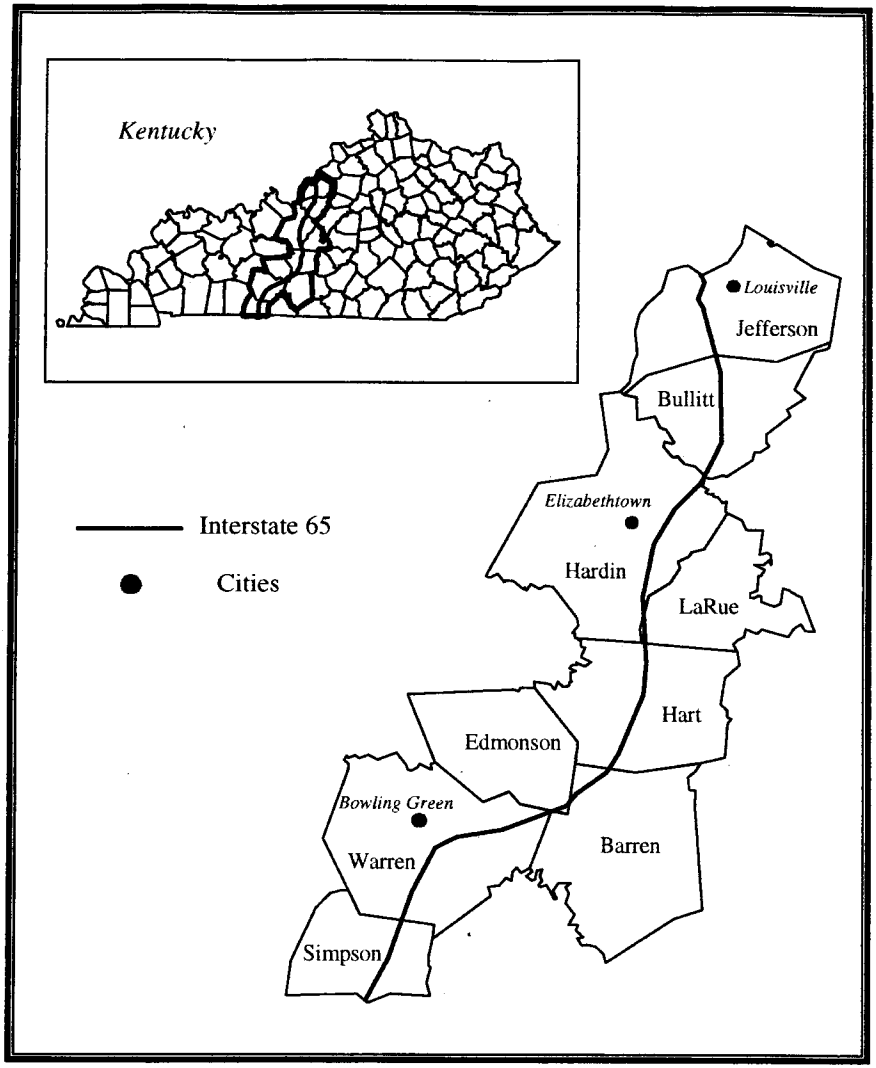


Figure 1-1

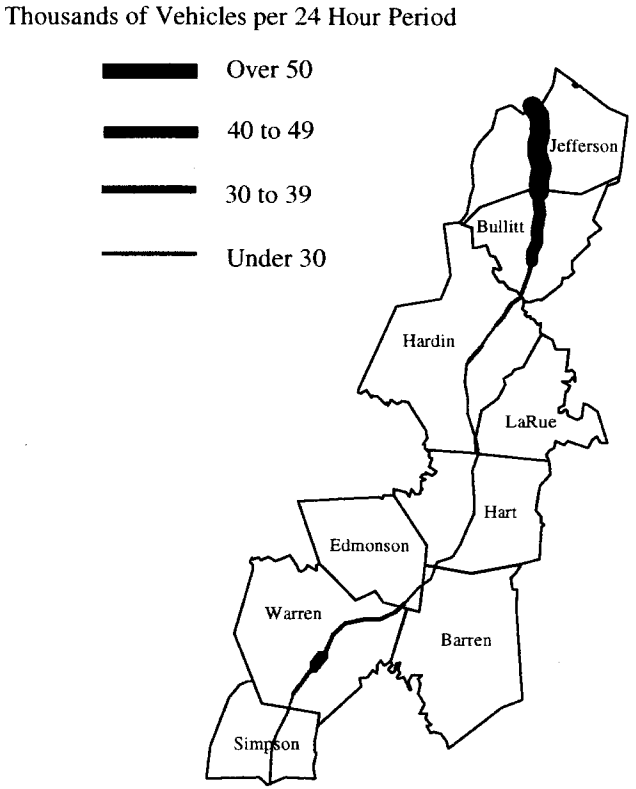
frequency, locational characteristics, and timing of truck movements of hazardous materials is the only solid foundation upon which any realistic and reasonable emergency response plan can be constructed. It is the intent of the research reported here to provide such an inventory to the Kentucky communities that comprise the I-65 corridor.

1.2 The I-65 Corridor in Kentucky

Interstate 65 is a north/south oriented, limited access highway which plays an important role in economically integrating the southern U.S. and northern U.S. consumer and producer markets. Producer goods and consumer goods flow in large quantity in both directions from points of production/distribution to points of consumption and storage. This interstate corridor, which stretches from just southeast of Chicago to Mobile, Alabama has received massive private sector investment with major automobile assembly plants located just outside Chicago (Chrysler), Indianapolis (Subaru), Louisville(Ford), Bowling Green (Corvette), Nashville (Saturn in Spring Hill, Nissan in Smyrna), and Birmingham (Mercedes in Nance). These huge hubs of assembly activity have, in turn, attracted a wide variety of parts and components producers along the entirety of the I-65 corridor, especially the region south of Indianapolis and north of the Tennessee/Alabama border. The I-65 corridor also has provided home to a large number of steel producing mini-mills. Additionally, Chicago, Indianapolis, and Nashville serve as important national/regional distribution centers to the dispersed retail markets in all cardinal directions. I-65 also intersects with key east/west corridors providing access to those markets via I-90, I-80, I-70, I-74, I-69, I-64, I-40, I-24, I-59, I-20, I-85, and I-10. Goods moving to and from Milwaukee and Minneapolis, to and from most of the southeast also would travel through Kentucky on I-65. As a direct result of the rapid growth of manufacturing and distribution activities within the corridor, truck traffic has grown in proportionate fashion. As the density of truck traffic increases, the density of trucks carrying hazardous materials (to be referred to as "hazmats" throughout the remainder of this report) also increases. Growth of population and households within the corridor also results in higher density automobile traffic which, in turn, increases the probability of accidents involving hazmats.

Within Kentucky, I-65 is a densely traveled 137 mile segment stretching from Louisville in the north to Franklin in the south. Intermediate communities include: Shepherdsville, Elizabethtown, Munfordville, and Bowling Green (see Figure 1-1). Nine Kentucky counties are cut by I-65 (Jefferson, Bullitt, Hardin, LaRue, Hart, Edmonson, Barren, Warren, and Simpson) and these define the corridor for purposes of the research reported here. These nine counties are home to 995,298 people as of 1995 (census estimates). This represents over one-fourth (25.6 percent) of Kentucky's population. Densities of population and economic activity vary considerably within the corridor. Jefferson County is home to just over two-thirds of the corridor's population. While the population of Warren and Hardin counties each exceeds 80,000, the population of Edmonson, Hart, and Simpson Counties is each under 20,000. The I-65 corridor represents one of the most industrialized interstate segments within Kentucky. There are 1277 manufacturing plants located within the corridor. However, 964 of these (75 percent) are located in Jefferson County alone. Warren County has 110 plants. There are under 10 manufacturing plants in each of Edmonson and LaRue Counties.

1992 TRAFFIC FLOWS, I-65 CORRIDOR



Source: Kentucky Transportation Cabinet, Department of Highways

Figure 1-2

Given this rather significant variation in urbanization, population densities, and manufacturing activities, large differences in traffic volumes are expected and they do exist. Traffic volumes on I-65 range from a minimum of about 23,000 vehicles per 24 hours to a maximum of approximately 116,000 vehicles per 24 hours (see Figure 1-2). I-65 traffic densities generally exceed 85,000 vehicles per 24 hours throughout the stretch between the Ohio River crossing (north) and the I-265 interchange (south) within Jefferson County. Volumes decrease in regular fashion south of Jefferson County. Northern Bullitt witnesses about 50,000 vehicles per 24 hours while the sections around Elizabethtown (Hardin County) experience about 30,000 vehicles per 24 hour period. Rural sections of I-65 see about 25,000 vehicles per 24 hours. Densities in the Bowling Green area are at roughly 40,000 vehicles per 24 hours.

SARA Title III provides identification of 360 Extremely Hazardous Substances (EHS). The Kentucky Division of Disaster and Emergency Services monitors fixed facilities (terminals, municipal water plants, manufacturing plants, etc.) that maintain storage of at least 500 pounds or a threshold quantity (whichever is less) of any EHS. According to this inventory of monitored fixed facilities, 261 locations provide storage of significant quantities of extremely toxic hazardous materials within the I-65 corridor (see Figure 4-1 in Chapter 4). These are clearly important places in the context of the current study because they provide focal points for the transportation (shipments into the facility and shipments out) of hazardous materials. Nearly 64 percent of the I-65 corridor's monitored facilities are found within Jefferson County. This concentration of activity involving the transportation, storage, and processing of hazardous materials is particularly noteworthy and emphasizes the need for effective planning and preparedness within this highly industrialized metropolitan region. Another significant cluster of fixed facilities (with significant stored quantities of EHS's) is found in Hardin County, especially Elizabethtown. Hardin County has 40 of these facilities, which is about 15 percent of the I-65 corridor's total. The number ranges between 2 (Edmonson) and 16 (Simpson) for other corridor counties. Warren County has disproportionately few monitored fixed facilities (only 7) given its large population and well developed industrial base. Whereas 66 percent of Hardin County's manufacturing plants are monitored, only 6 percent of Warren County's are.

1.3 Data and Methods

There are three primary sources of data that provide the basic information needed to assess important aspects of hazardous materials movements by truck (hazmats) within Kentucky's (-65 corridor. Each of these sources provides a different perspective on these transportation activities and each is summarized below.

PLACARD SURVEY. The single most important source of data is provided by field survey of trucks moving along the I-65 corridor, including those that exhibit a U.S.D.O.T. regulatory placard indicating shipment of hazardous content within the truck. A total of 600 observational hours took place throughout the period commencing on April 29, 1996 and concluding on July 7, 1996, providing coverage of the spring/summer seasons. Observational hours were systematically allocated so that comparisons of flow frequencies and compositions could be made between locations, e.g., north versus south regions, by time-of-day and day-of-week.

Meaningful examination of seasonal variation (in frequencies and composition) is not possible with the current (I-65) databases. For examination of seasonal variation, the reader is referred to ***THE I-64 HAZARDOUS MATERIALS, COMMODITY FLOW ANALYSIS*** (Frankfort: The Kentucky Emergency Response Commission, 1995). Field observations were made at 4 designated sets of focal points (please see Figure 1-3). One set of focal points (north and south lanes) is located north of the Kentucky/Indiana line, just north of the Ohio River crossing. This permits assessment of northbound hazmat movements out of the Louisville urbanized area, as well as southbound movements of hazmats entering the Louisville urbanized area. Another strategic set of focal points was established just south of the Louisville downtown area. This permits careful assessment of materials (and timing) moving through this densely built-up area. The remaining sets of focal points are located at weigh stations in Elizabethtown (Hardin County) and Franklin (Simpson County). These are crucial for detailing flows in the central and southern portions of the I-65 corridor. These observations are used to represent flows in the Louisville (northern), central, and southern I-65 regions. All hours of field observation give real indications of flow values. Two experienced (from I-64 and I-75 hazmat studies) observers accomplished all field observation. During any hour of observation, the following information was noted on standardized forms:

-time of day	-day of week
-date	-location
-number of trucks	-number of hazmats.

Additionally, for each placarded hazmat observed, all placard information was recorded as well as the carrier name.

TRANSPORTATION INCIDENT RECORDS. A complete five year history (January 1991 through December 1995) of transportation incidents involving trucks carrying at least one type of hazardous material within the I-65 corridor was compiled from a master listing of three independent data sources. These data sets are:

Federal data for the I-65 corridor obtained from the Hazardous Materials Information System of the U.S. Department of Transportation;
State data provided through the Kentucky Department of Environmental Protection, Emergency Response Team, Transportation Incident Report;
Local data provided on incident report sheets submitted by local emergency and fire units to the Kentucky Fire Marshal, Division of Hazardous Materials.

These incident data were electronically collated so that redundancy is removed from the final master database. A total of 554 incidents over five years from 1991 through 1995 involving truck transportation of hazardous materials make up this master database. Place (county of occurrence), time of incident, and type of hazardous material(s) are recorded for each incident included in the historical record.

A separate database for the immediate I-65 corridor within Jefferson County was analyzed. This database is supplied by Jefferson County's municipal sewer authority and is referred to as the MSD (Metropolitan Sewer Data) database. It includes all transportation incidents that involved release of any quantity of hazardous material to the sewer system, including incidents that do not

THE I-65 CORRIDOR IN KENTUCKY
(Points of Observation)

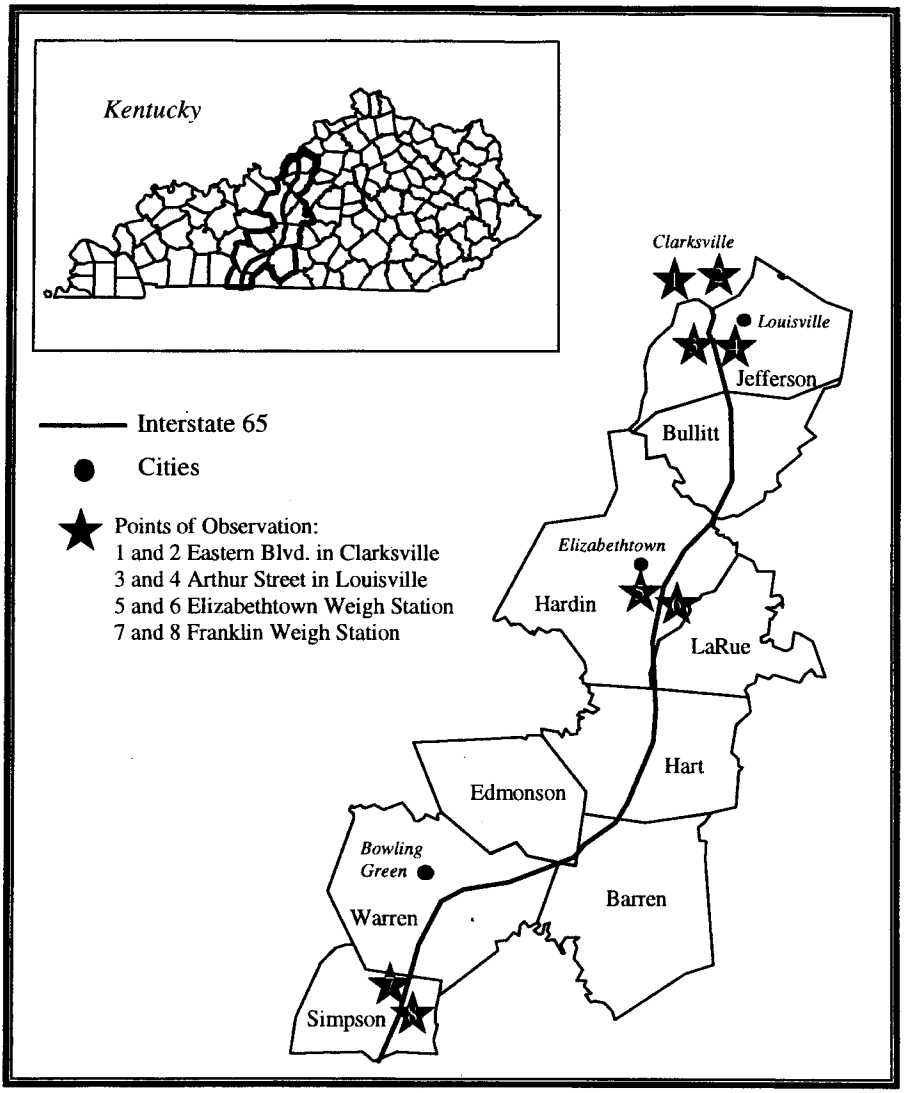


Figure 1-3

involve hazmats (trucks). Many minor incidents involving the release of relatively small quantities of fuels are included in this MSD database. Its (MSD) chief advantage is that it provides a close-up of the immediate I-65 corridor within Jefferson County. Frequencies of incidents along the corridor within a county is generally not possible with the other databases because locational information is very limited. The Jefferson County MSD database will be carefully geo-coded, mapped, and analyzed for any possible spatial patterns, i.e., trouble spots within the metro area.

FIXED FACILITY SURVEY. A questionnaire was sent to each of the 261 fixed facilities currently monitored by the Kentucky Division of Disaster and Emergency Services. The three page questionnaire includes 40 response items (see Appendix A). Questions were designed to elicit general patterns of hazardous materials shipments into and out of each facility. Frequencies of shipments, modes of transportation used, timing, normal routing to the nearest interstate segment (including I-65), and additional shipping information for each of the five most frequently shipped (or received) hazardous materials were requested from each facility contacted. Of the 261 fixed facilities surveyed, 81 (31 percent response rate) questionnaires were returned with useable information. In general, this is a good response rate and the sample size of 81 is capable of providing a vivid picture of hazmat movements within the corridor at the local level.

These three primary databases provide a rich source information resource from which to construct a detailed picture of truck transportation of hazardous materials within the I-65 corridor and the risks associated with these movements. A review of existing commodity flow studies reveals that Kentucky's ongoing hazmat research agenda is superior in terms of breadth of area coverage and depth of accurate observation. (For such a review and statement of good study design elements, please see **GUIDANCE FOR CONDUCTING HAZARDOUS MATERIALS FLOW SURVEYS**, U.S.D.O.T., 1995). Each of the three databases is analyzed separately with special attention given to discovery of any spatial or temporal trends that might exist and be of use to the emergency response planning efforts within the I-65 corridor. In all cases, maps, graphs, tables, and summary statistics are used to provide clarity and precision when portraying these trends.

Although the databases have been assembled to provide the best possible representation of hazmat flows, they are not void of limitations. Great attention was given to quality control and data gathering activities were closely monitored by the principal investigator. However, errors can occur in small, yet unknown quantity. Observational error, recording error, data entry error, and nonresponse error (in the survey of fixed facilities) are all potential sources of error. Additionally, no attempt was made to assess the quantity of hazardous materials to be found within trucks during the placard survey. Should any user of this report find any data or interpretation to be suspect, he or she is invited to make that concern known to the Kentucky Emergency Response Commission (502-564-5223) or to the principal investigator (Ron Mitchelson at Morehead State University at 606-783-2655).

1.4 Organization of the Report

The remainder of this report is organized around the summary of findings derived from each of the three databases. Chapter Two deals with description and analysis of the 5 year historical record, i.e., 1991 through 1995, of hazmat incidents within the I-65 corridor. A separate analysis is provided for the MSD data depicting incidents within Jefferson County along I-65. Chapter Three provides summary of the findings based on analysis of the 600 hour placard survey conducted within the I-65 corridor between April 1996 and July 1996. Next, Chapter Four provides analysis of the fixed facility survey which provides crucial information about the manner in which trucks gain access to I-65 from nearby points of production and storage. Chapter Five provides an effective summary of the empirical results of the I-65 study and relates these findings to possible policy implications. Finally, Chapter Six includes a brief comparison of the I-65 findings to two previous corridor studies in Kentucky, I-64 and I-75. Two appendices provide a copy of the fixed facility questionnaire (Appendix A) and example pages from each of the three primary databases (Appendix B): placard survey, historical incidents, and facility survey.

CHAPTER TWO

FIVE YEAR HISTORY OF TRANSPORTATION INCIDENTS INVOLVING HAZARDOUS MATERIALS WITHIN THE I-65 CORRIDOR

After collating federal, state, and local information sources as described in the previous chapter, it is determined that 554 transportation incidents involving trucks carrying at least one type of hazardous material have occurred in the I-65 corridor within the past five years, i.e., January of 1991 through December of 1995. Review of the regional metropolitan newspaper, the Louisville Courier-Journal, accounts for one sample year, namely 1994, provides added confidence in the validity of the collated master I-65 hazmat incident database.

2.1 Total Incidents, 1991-1995

Figure 2-1 and Table 2-1 summarize the number of hazmat incidents which have occurred over the five year history. The total of 554 hazmat incidents yields an average number of nearly 111 incidents per year within the I-65 corridor. The maximum annual incident total (163 in 1993) is twice as large as the annual minimum frequency (79 in 1991). This "peaking" phenomenon always presents a problem to planners, because they generally have to plan for the peak. This necessarily results in inefficiency during off-peak periods. Additionally, as can be seen in Figure 2-1, there was a trough of incidents during the early years of the time series, with a peak of incidents in 1993, and decreased frequencies in 1994 and 1995. This time series is substantially different from those which were revealed for the I-64 and I-75 corridors. In those cases, the peak was achieved at the end of their respective time series, 1994. There was an early trough of incidents which generally corresponded to a downturn in the U.S. business cycle. The historical record of hazmat incidents within the I-65 corridor does not correlate as well with general indicators of the U.S. business cycle although there is a correlation. The increase in incidents (79, 98, 163) between 1991 and 1993 corresponds quite well with the general U.S. economic recovery of the early 1990s. As the national economy recovered from recessionary pressure during the early 1990s, industrial production, factory orders, the volume of truck movements, the number of hazmats on the highways, and the number of truck accidents (and hazmat incidents) all increased in concert.

Local emergency response planners are thus encouraged to monitor the basic set of national economic indicators that are commonly reported in newspapers and other popular business-oriented media, e.g., ***BUSINESS WEEK***. For example, the index of manufacturing output is a reliable predictor of total truck transportation activity in general and the movement of hazardous materials in particular. Since most hazardous materials are producer goods (in contrast to consumer goods), those indexes that measure producer activity (in contrast to consumer activity like housing starts or retail sales) are superior predictors of the frequency of hazmat movements

NUMBER OF TRANSPORTATION INCIDENTS INVOLVING HAZARDOUS MATERIAL, I-65 CORRIDOR, 1991 TO 1995

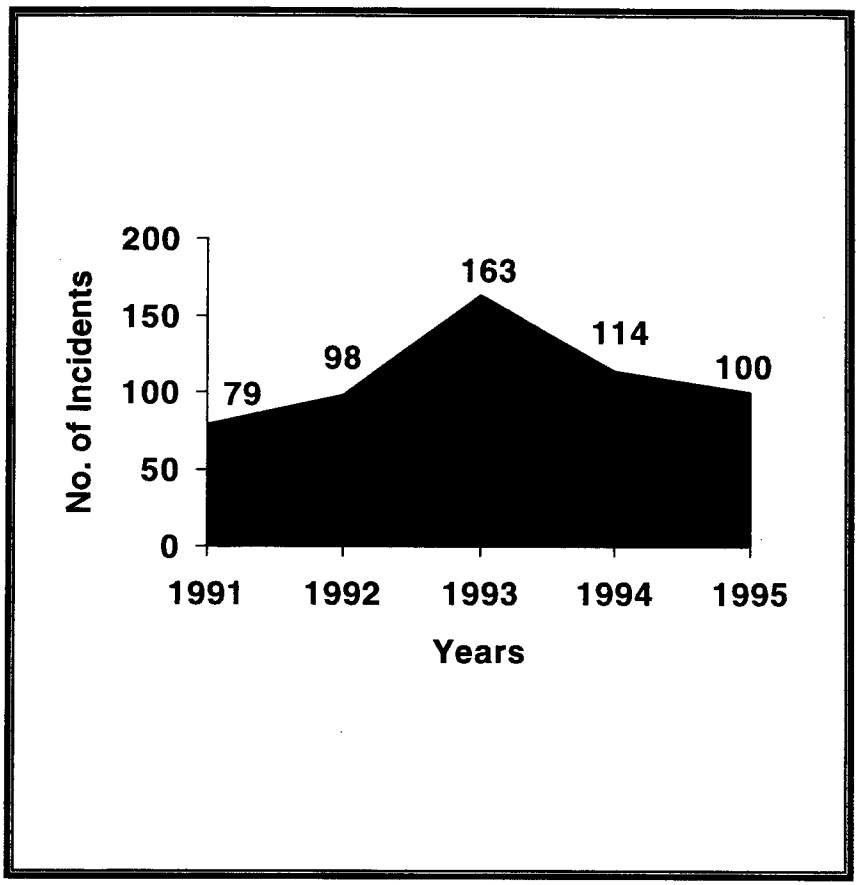


Figure 2-1

Table 2-1

TOTAL NUMBER OF TRANSPORTATION INCIDENTS INVOLVING HAZARDOUS MATERIALS IN THE I-65 CORRIDOR, BY COUNTY, 1991 TO 1995

	Year					
County	**1991**	**1992**	**1993**	**1994**	**1995**	**Total**
Barren	3	0	2	4	2	11
Bullitt	6	4	3	5	3	21
Hardin	9	6	10	11	6	42
Hart	2	5	2	2	4	15
Jefferson	49	71	135	80	70	405
LaRue	1	0	2	0	0	3
Simpson	1	2	2	2	3	10
Warren	8	10	7	10	12	47
Total	79	98	163	114	100	554

Sources: (1) U.S.D.O.T., Hazardous Materials Information System.(HMIS) (2) Office of State Fire Marshal. Division of Hazardous Materials, Individual Incident Reports. (3) Kentucky Department of Environmental Response, Incidents Database.

(and their resulting incident frequencies). Examples of accessible indexes of economic activity include: The Supplier Performance Index (National Association of Purchasing Management), and Manufacturers' New Orders (U.S. Department of Commerce). Both values are published monthly and are carried in the business section of any metropolitan newspaper.

The decreased number of incidents in the later portion of the time series (1994 and 1995) is generally an unexpected result. The national economy has experienced no significant downturn since 1993. Manufacturers' Orders have remained relatively stable. It is possible that the national economic recovery of 1992 and 1993 was accompanied by a disproportionately large surge of producer activity associated with depleted inventories and that the later years are more representative of a relatively "normal" relationship between the general volume of economic activity and truck shipments. Hence, peak truck traffic is witnessed immediately following a sustained recessionary period and the frequency of hazmat incidents simply mimics this flush of activity.

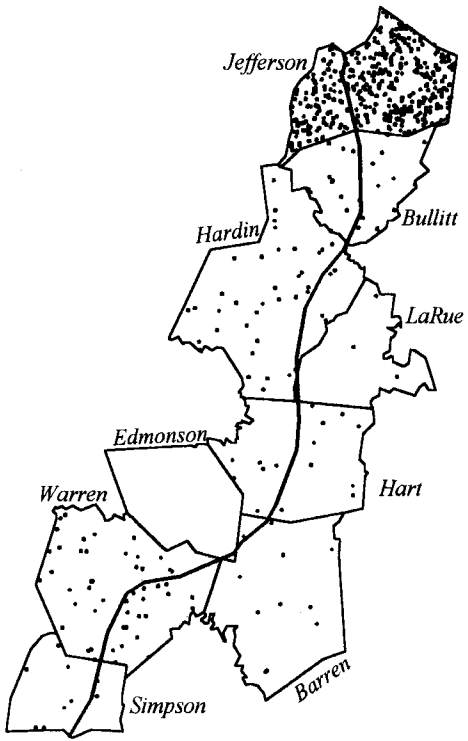
2.2 The Spatial Distribution of Hazmat Incidents

Figures 2-2 and 2-3 provide graphic illustration of where incidents involving the trucking of hazardous materials take place within the I-65 corridor. Over the five years under scrutiny here, 1991 through 1995, Jefferson County (Louisville) accounted for just over 73 percent of the corridor's 554 hazmat incidents. Nearly 3 out of every 4 hazmat incidents occurring within the corridor take place in Jefferson County. This level of spatial concentration in the Louisville area is noteworthy. No other corridor studied to date (I-64 or I-75) can claim such an extreme level of spatial concentration of hazmat incidents. Warren and Hardin Counties each contributed about eight(8) percent to the total over the five year period. The frequency of incidents within the I-65 corridor is strongly correlated with general levels of urbanization and their correspondingly higher traffic densities. It is also evident that the frequency of hazmat incidents is more strongly (and statistically) related to the level of urbanization than it is to the location of monitored (for EHS) fixed facilities.

As noted in Figure 2-2 the relative dominance (in accounting for annual hazmat incidents within the I-65 corridor) of Jefferson County varies substantially over the five year historical record. When total incidents are at a minimum in the I-65 corridor, i.e., 1991, so is Jefferson's share of those incidents at a minimum, i.e., 62 percent share. However, when the corridor's incident frequency is at its maximum, Jefferson's share of incidents also is maximized, i.e., 83 percent share. Apparently, when the natioanl economy is in an upward swing, the number of hazmat incidents not only increases in total number but they also become more heavily concentrated in densely built-up metropolitan settings. This was also the case in the I-64 and I-75 studies.

In the aggregate, Jefferson County averages 81 hazmat incidents per year (in excess of 20 more per year than Fayette). In stark contrast, Edmonson had no recorded incidents in the five year period so its average annual rate is 0. The average annual hazmat incident rate for other counties in the I-65 corridor are as follows:

INCIDENTS INVOLVING HAZARDOUS MATERIALS IN THE I-65 CORRIDOR 1991 TO 1995



One Dot = One Transportation Incident

PERCENT OF INCIDENTS LOCATED IN JEFFERSON COUNTY

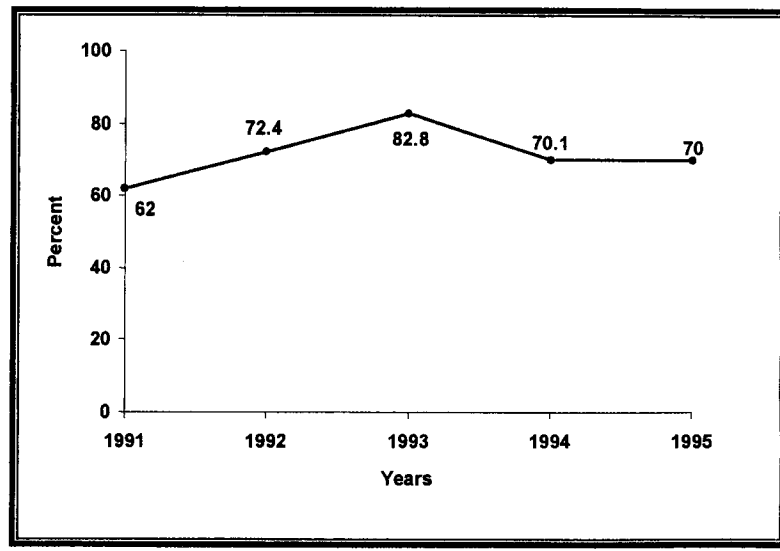


Figure 2-2

NUMBER OF TRANSPORTATION INCIDENTS INVOLVING HAZARDOUS MATERIALS IN THE 1-65 CORRIDOR, BY COUNTY, 1991 TO 1995

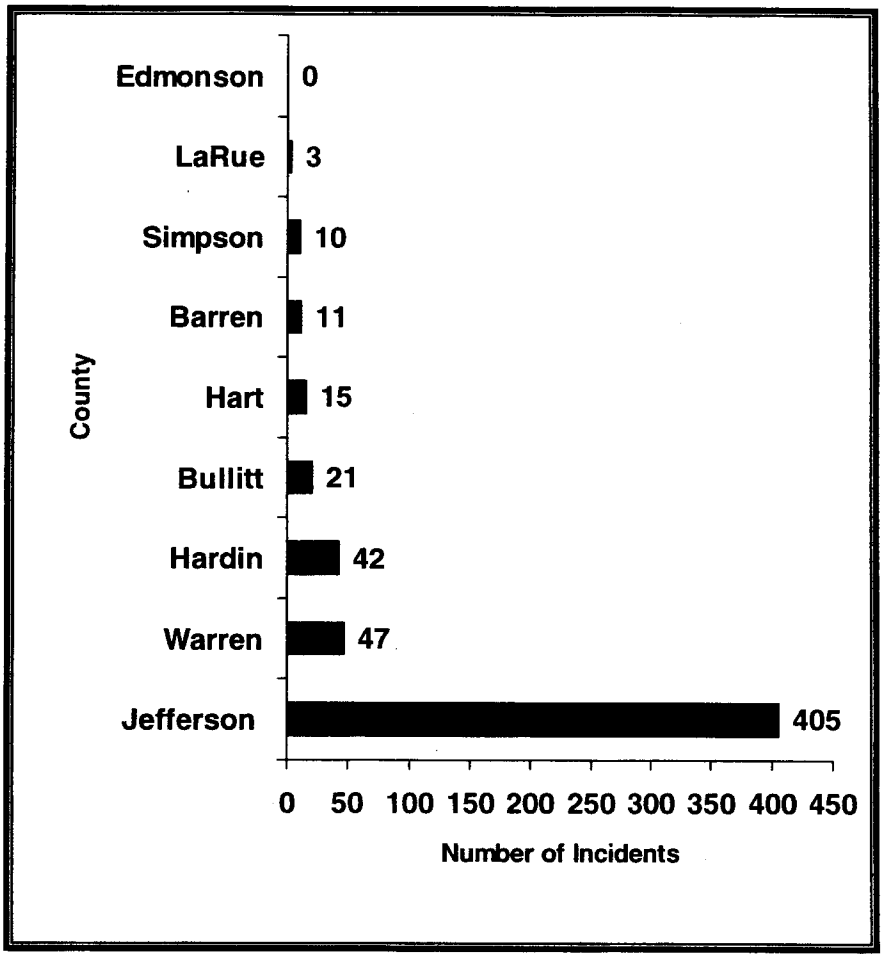
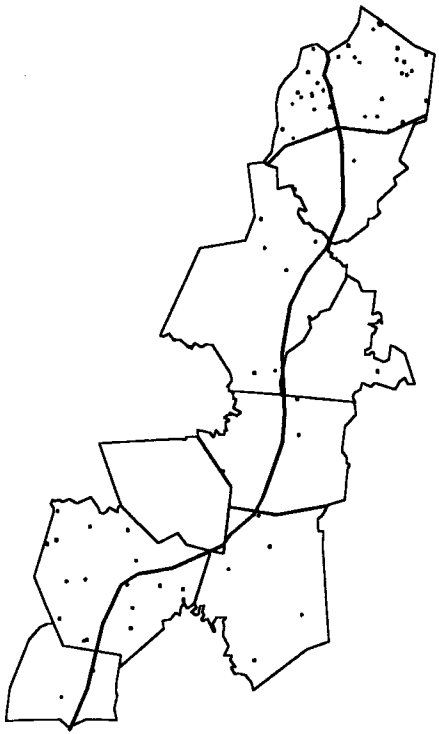


Figure 2-3

MAJOR INCIDENTS INVOLVING HAZARDOUS MATERIAL IN THE I-65 CORRIDOR, 1991 TO 1995



One Dot = One Major Transportation Incident

PERCENT OF MAJOR TRANSPORTATION INCIDENTS, BY COUNTY, 1991 TO 1995

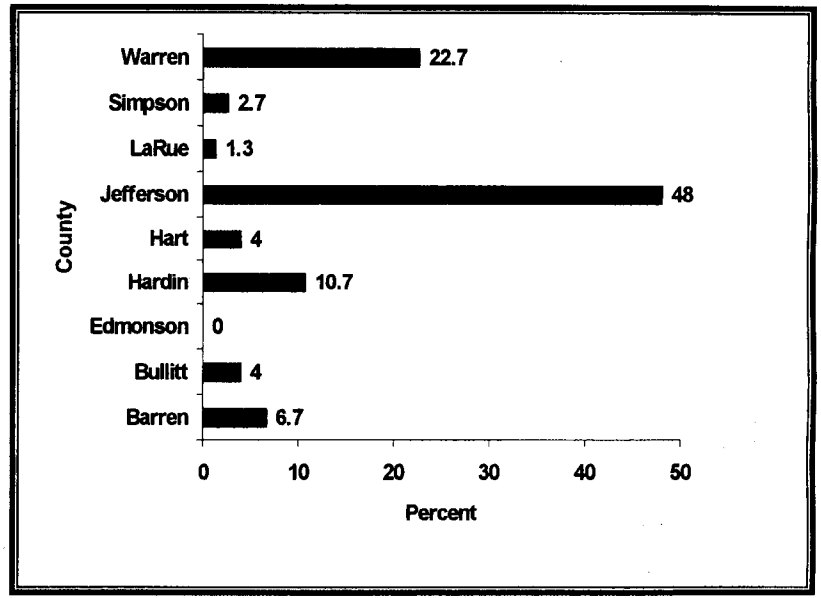


Figure 2-4

Warren	9.4	Barren	2.2
Hardin	8.4	Simpson	2.0
Bullitt	4.2	LaRue	0.6
Hart	3.0	Edmonson	0.0.

Regardless of incident rate levels, effective response to future incidents, regardless of how frequently they might occur, is predicated on adequate preparation in terms of personnel and equipment.

For purposes of this report, a "major" incident is defined as one involving the release of at least 100 pounds of dry hazardous material or at least 100 gallons of fluid hazardous material. It is acknowledged that the seriousness and potential risk associated with any spill varies with the exact nature of the material released. However, with use of this definition, 75 major hazmat incidents took place within the I-65 corridor during the period commencing in January, 1991 and ending in December, 1995. This yields an average of 15 major incidents per year. Figure 2-4 exhibits the distribution of these major events within the I-65 corridor. This type of hazmat incident is far less spatially concentrated than is the total number of hazmat incidents. Major events are more uniformly spread over the extent of the corridor. For example, although Jefferson County contributes 73 percent of total hazmat incidents, it provides "only" 48 percent of the major incidents. It is evident that higher traffic densities at lower velocities, as would be more typical of a metropolitan setting, provide an environment of frequent, low velocity accidents, many of which are less dangerous. In contrast, although Warren County contributes only 8 percent of total hazmat incidents, it contributes a disproportionately large 23 percent share of major incidents. The annual rate of major hazmat incidents for the I-65 counties is as follows:

Jefferson	7.2	Bullitt	0.6
Warren	3.4	Hart	0.6
Hardin	1.6	Simpson	0.4
Barren	1.0	LaRue	0.2
		Edmonson	0.0.

Over one third of Warren County's hazmat incidents could be considered as major (by the definition adopted here). Only nine(9) percent of Jefferson's are considered major.

2.3 Composition of Hazardous Materials Involved in Incidents

The 554 hazmat incidents that took place in the I-65 corridor from 1991 to 1995 involved the release of 80 different hazardous materials. Each of these substances was released with varying frequency during the five year period. Most were rarely involved, e.g., 37 of the 80 (46 percent) hazardous materials were released only once during the five years under scrutiny. Other materials were released much more frequently as is illustrated in Figures 2-5 and 2-6. For example, 298 (54 percent of total) involved the release of placard 1993, most of which is diesel fuel (70 percent of the 1993 placard incidents). Most of these, in turn, are fuel spills and were not classified as "major" incidents. Gasoline (placard 1203) and liquid acid (placard 1760) were

FIVE YEAR FREQUENCY OF TRANSPORTATION INCIDENTS INVOLVING HAZARDOUS MATERIALS IN THE I-65 CORRIDOR

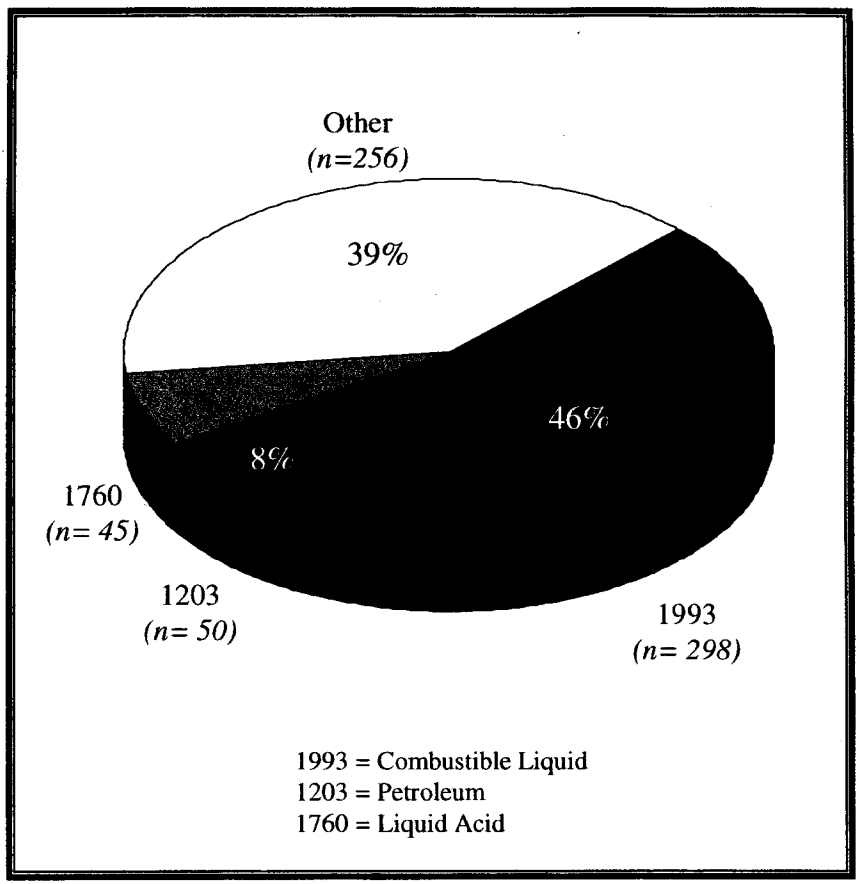


Figure 2-5

released with nearly equal frequency during the five years within the I-65 corridor. Gasoline was released 50 (10 occurrences per year) times and acid was spilled 45 times (9 occurrences per year) between 1991 and 1995. The "Other" category contained in Figure 2-5 is disaggregated in Figure 2-6. Each of these hazardous materials was released at least once per year within the corridor between 1991 and 1995. Please note that Ethylene was released over four times per year. As a result, each of these substances (indicated in Figures 2-5 and 2-6) should be regarded as posing a significant risk to inhabitants of the corridor's communities.

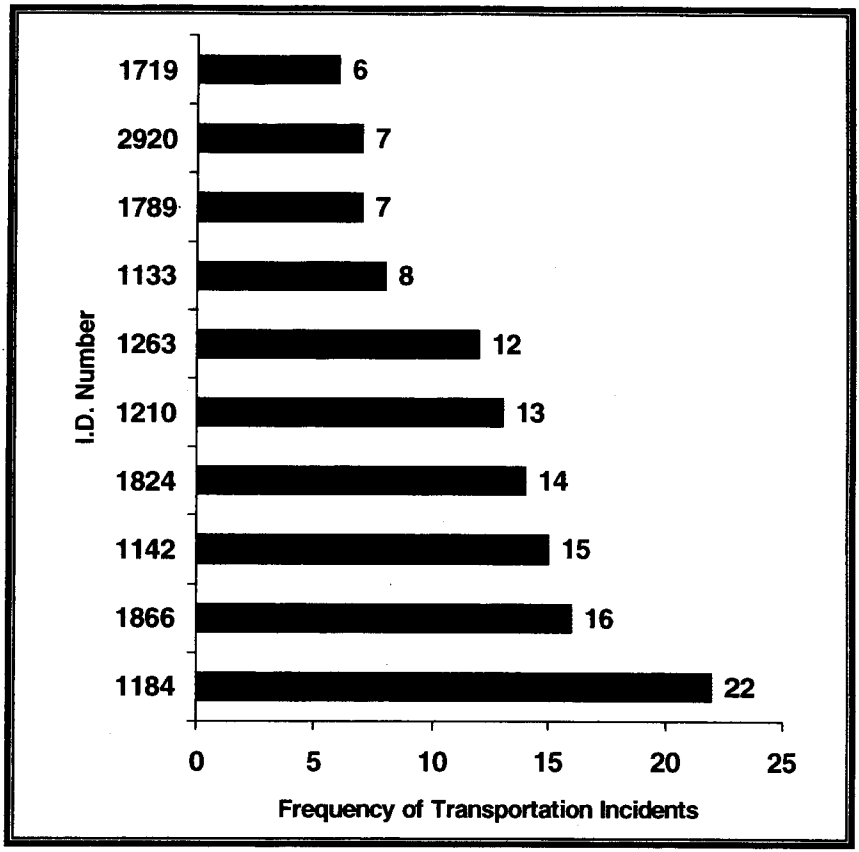
Quite clearly, emergency response teams located within the I-65 corridor should be prepared to cope with releases of materials such as diesel fuel and gasoline based on broad gauged analysis of the five year history. These releases are quite common occurrences given these materials' abundance in production, storage, and transportation. However, the range of hazardous materials released to the environment varies significantly from one jurisdiction to another. Jefferson County witnessed the release of 66 different hazardous materials during the five years studied. This variety is somewhat proportionate to the total number of incidents that took place within Jefferson County. Jefferson County witnessed 73 percent of the hazmat incidents that took place in the corridor and about 80 percent of the different hazardous materials released within the corridor. Nodal cities such as Louisville, where several interstate routes intersect (I-64 and I-65), will normally experience a wider variety of materials than places cut by a single interstate route. This was also noted in Lexington's case, where I-64 and I-75 traffic resulted in the release of 72 different materials between 1990 and 1994. Figure 2-7 details the variety of materials released as a result of hazmat incidents in the counties of the I-65 corridor. The involvement of diesel fuel was the most commonly recorded material in hazmat incidents in each of the corridor's counties.

It is very apparent that the difficulty of remaining properly prepared to respond to the release of hazardous materials within any local jurisdiction is at least partly tied, and in proportion, to the variety of materials experienced there. In this context, the simple fact that Jefferson County has witnessed nearly five times as much variety in released materials (due to hazmat incidents) as the second ranked county (Warren) in this regard, makes training and planning disproportionately difficult in the Louisville area.

2.4 Analysis of Response Guides Based on Five Year Frequencies

The United States Department of Transportation publishes a guidebook which describes appropriate action on the part of responders during the early phase of a hazardous material incident, ***THE 1996 NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK***.. The 1996 printing is used in this report to highlight the frequency of recommended response guides based on the frequency of released hazardous materials involved in hazmat incidents within the I-65 corridor between 1991 and 1995. Please note that there are 62 different response guides numbered 111 through 172 in the ***GUIDEBOOK***. The appropriate response to each hazardous material is assigned a guide number, which is also associated with a brief description of the sorts of dangers that the material presents and appropriate actions when accidentally released. It is hoped that by directly relating the findings of the five year history to the ***GUIDEBOOK***, then the practical utility of the current study to local emergency planning committees will be illustrated

HAZARDOUS MATERIALS FREQUENTLY REPORTED IN TRANSPORTATION INCIDENT REPORTS, I-65 CORRIDOR, 1991 TO 1995



1133 = Adhesives
1142 = Anti- Freeze
1184 = Ethylene
1210 = Printing Ink
1263 = Paint
1719 = Caustic Alkali Liquid
1789 = Hydrogen Chloride
1824 = Caustic Soda
1866 = Resin Solution
2920 = Corrosive Liquids

Figure 2-6

VARIETY OF MAJOR HAZARDOUS MATERIALS INVOLVED IN TRANSPORTATION INCIDENTS, BY COUNTY, 1991 TO 1995

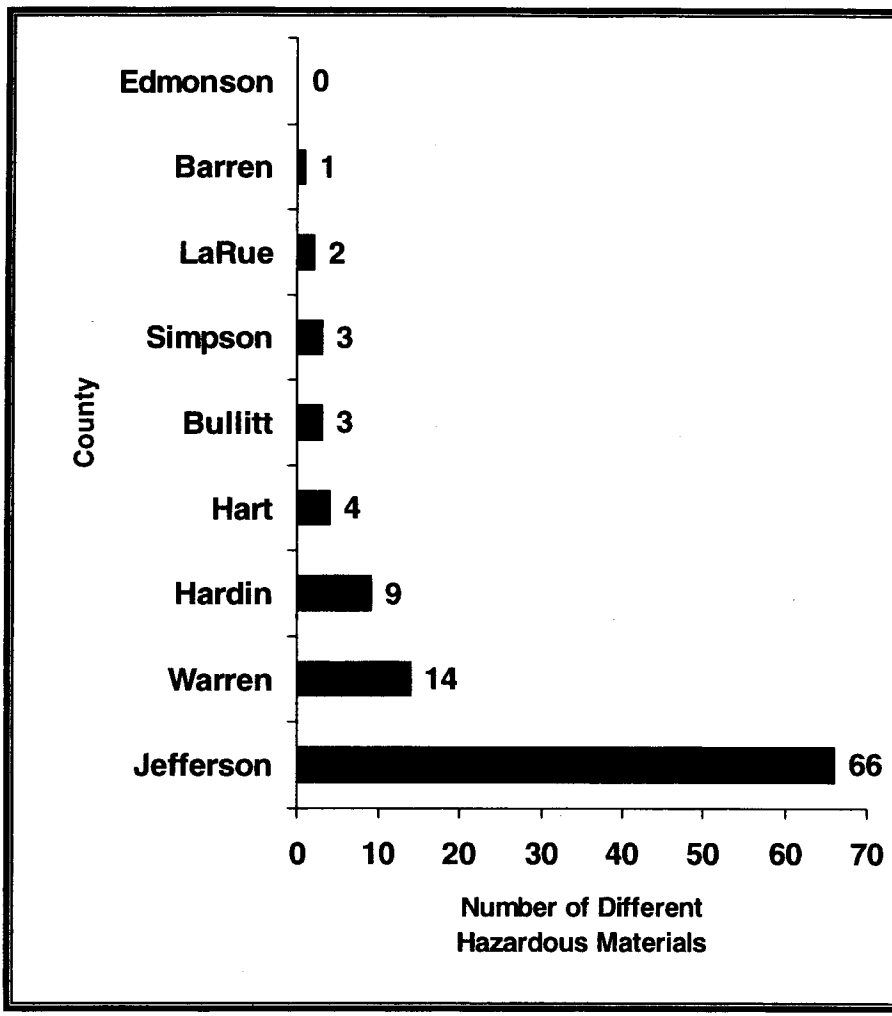


Figure 2-7

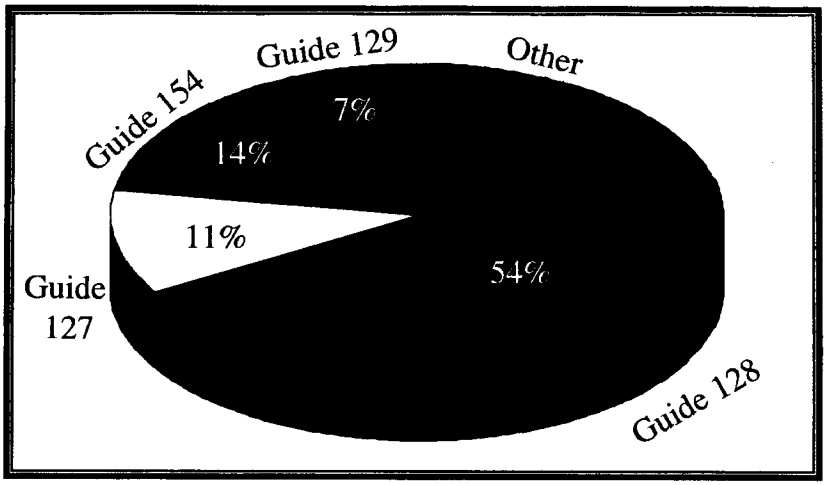
and enhanced. Professionals in the field should be able to expand on this usefulness (policy recommendations, training materials, etc.) through time.

Two related issues deserve at least minimal attention before discussing the results associated with the ***GUIDEBOOK***. First, although the ***GUIDEBOOK*** is the most popular set of standards currently being used by the emergency response community, a number of other appropriate and published response standards do exist. If individuals are interested in these other standards, please direct inquiries to the Kentucky Emergency Response Commission. Second, readers are cautioned that although one response might be deemed as "more important" than others because it is associated with materials more frequently involved in transportation incidents, this does not imply that training and preparedness should focus on one, or just a few, response guides. Training should be inclusive and systematically designed to provide wider knowledge of responses along with frequent review of those response types that are known to be frequently required within the jurisdiction.

Figures 2-8 and 2-9 along with the content of Table 2-3 clarify the relative importance of each response guide number based on the simple frequency of types of hazardous materials released during hazmat incidents within the I-65 corridor between 1991 and 1995. Guide number 128 (flammable liquid, water immiscible) is of obvious importance because it represents 54 percent of the appropriate responses that should have occurred during the five years. Within the I-65 corridor, this type of response, i.e., Number 128, is invoked just over 54 times per year if emergency response teams actually responded "by the book". Guide Number 154 (response to noncombustible corrosives) is the second most frequently occurring response over the five year history, with 14 percent of the total. This response type was needed over 13 times per year within the corridor. The third most frequent response type is Guide Number 127 (flammable, water miscible) with about 11 percent of total appropriate responses. The last very frequently required response is Number 129 (flammable, noxious), with about 7 percent of the total and being required just over 7 times per year within the I-65 corridor. Please note that the "Other" category in Figure 2-8 is disaggregated in Figure 2-9. Response Guide Number 132 (flammable and corrosive liquids) is required just over twice per year and requires serious consideration in all training efforts by emergency response teams throughout the corridor. Response Guides 126, 131, 137, 157, 160 and 171 are each required about once per year and should also be explicitly included in training curricula. Please realize that most of these response types do involve the use of more specialized equipment that clearly exceeds the functionality of the typical fire fighter's turn-out gear.

As noted above, Guide Numbers 127 and 128 dominate the expected frequency of required responses based on the past five year record within the I-65 corridor. However, the portfolio of required responses does vary from one jurisdiction to another, i.e., from one county to another within the corridor. Table 2-3 is important because it provides a county-by-county assessment of Guide Number frequencies based on the local mix of hazmat incidents over the past five years. Response Guide Number 128 is the most frequently required response type in all corridor counties with the exception of Edmonson County, which had no spill reported during the five years being studied here. Response Guide 154 is the second most frequent required type in 3 counties (Hart, Jefferson, Warren). Response Guide Number 129 places second in two counties

RELATIVE FREQUENCY OF RECOMMENDED RESPONSES TO TRANSPORTATION INCIDENTS IN THE I-65 CORRIDOR



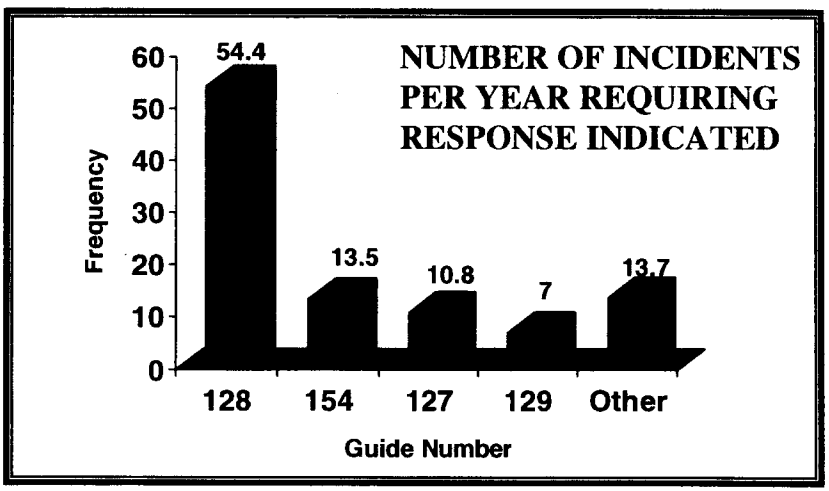


Figure 2-8

ANNUAL RECOMMENDED RESPONSES* TO TRANSPORTATION INCIDENTS IN THE I-65 CORRIDOR, 1991 TO 1995

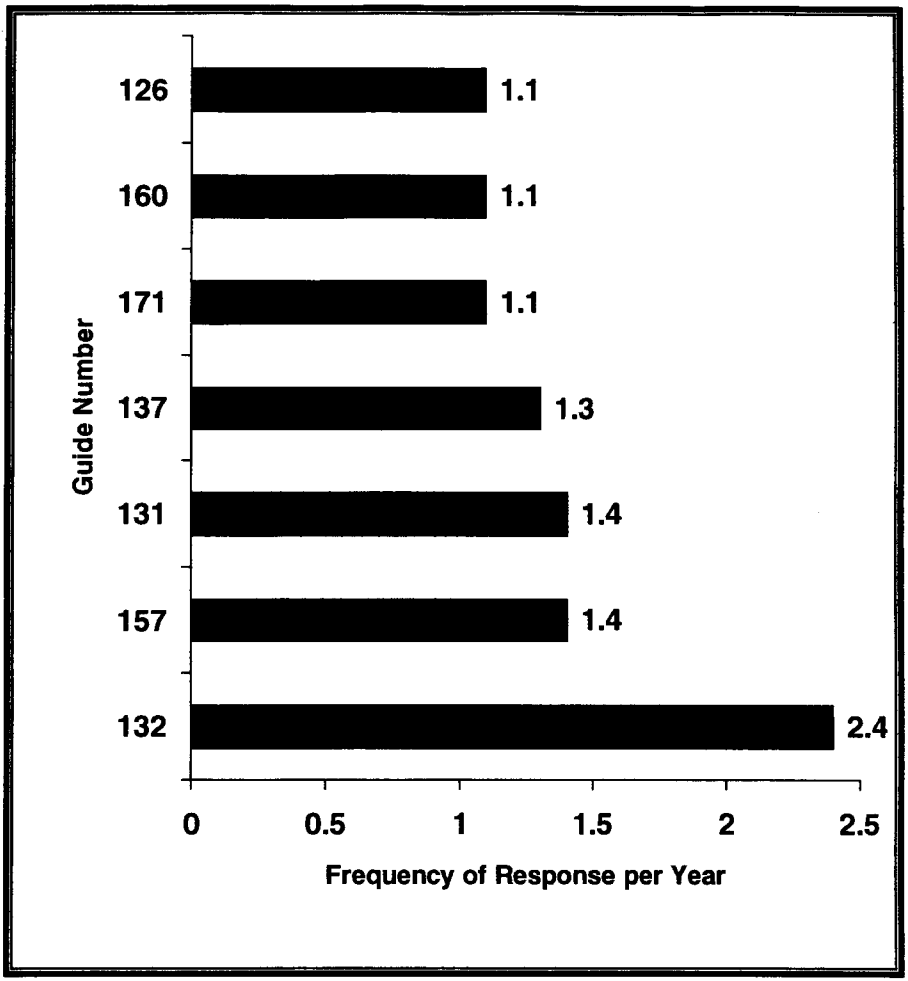


Figure 2-9

* 1996 North American Emergency Response Guidebook, U.S.. Department of Transportation

Table 2-3

FREQUENCY OF RECOMMENDED RESPONSES TO TRANSPORTATION INCIDENTS IN THE I-65 CORRIDOR, BY COUNTY, 1991 TO 1995

Counties	EGR Guide Number (Occurrences Per Year)		
	Most Frequent	Second	Third
Barren	128 (2.0)	0	0
Bullitt	128 (3.6)	146 (0.2)	0
Edmonson	0	0	0
Hardin	128 (6.3)	129,132 (0.4)	125,127,137 (0.2)
Hart	128 (2.3)	154 (0.2)	171 (0.2)
Jefferson	128 (32.0)	154 (12.6)	127 (9.9)
LaRue	128 (0.4)	138 (0.2)	0
Simpson	128 (1.4)	129 (0.2)	160 (0.2)
Warren	128 (6.3)	154 (0.7)	127 (0.7)

(Hardin and Simpson). A nonsystematic mix of required responses comprises the remainder of the top three in each county (see Table 2-3).

It is apparent from this type of analysis that communities within the I-65 corridor need to be very well versed and highly practiced in a select number of required response guides, e.g., 128, 127, 129, and 154. However, these same corridor communities need to pay careful attention to selected Guides that reflect unique situations found within the corridor, e.g., 126, 131, 132, 137, 157, 160, and 171. The high frequency (and needed training emphasis) on Guides 128, 127, and 129, and 154 provides a common denominator with other corridors (I-64, I-75). However, the second tier of frequently required responses seems to be relatively unique to the corridor. Communities within the corridor, and their respective emergency response planners, are cautioned that although these frequently required Guide Numbers might receive additional focus and reinforcement over the course of an on-going training program, training for all emergency response personnel should remain broad based and inclusive. Finally, readers are encouraged to note the example page taken form the collated "Master Incident File" that forms the basis of graphics, tables, and statements contained in this Chapter. That page is included in Appendix B of this report.

2.5 Metropolitan Sewer Data, Jefferson County

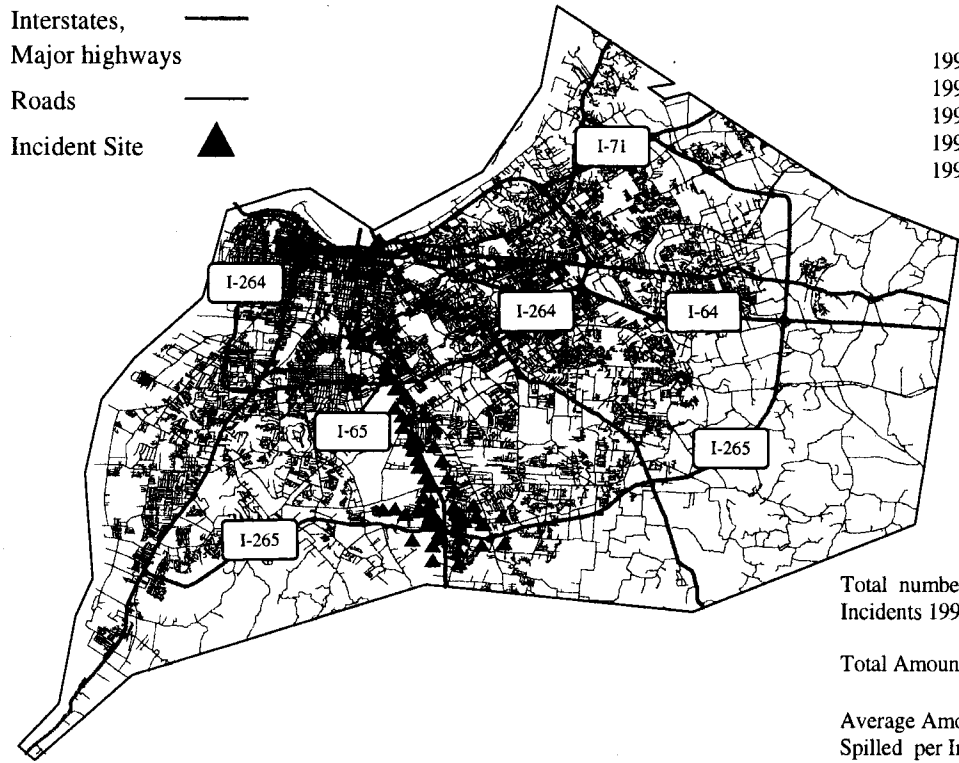
Figure 2-10 summarizes data provided by Louisville's municipal sewer system. This is a valuable source of information from the perspective that it provides more detailed locational information than the other databases used previously to construct the five year history for the corridor in general. However, the MSD data are limited by inclusion of Jefferson County I-65 incidents only. This database includes any motor vehicle incident that provided release of any hazardous material that might enter the municipal sewer system. At least 7 percent of these reported incidents involve automobiles and small (although very dangerous) releases of gasoline. The vast majority of incidents involve the release of diesel fuel, about 65 percent of total.

During the past five years for which data are complete, 1991-1995, there were 74 incidents reported as taking place on I-65. A total of 3105 gallons of hazardous material were spilled during the course of these incidents. This yields an average release of 42 gallons per incident. The predominance of the incidents occurred outside the I-264/I-65 interchange. Nineteen (26 percent) occurred within the I-264 interchange while the remainder, 55 incidents (74 percent), occurred outside the interchange. Within the I-264 region, a significant cluster of incidents takes place within the area intersected by I-264, I-64, and I-65 (commonly referred to as the local version of "Spaghetti Junction"). Outside I-264, a large cluster of incidents is experienced in and around the I-265/I-65 interchange. A distinctively large number of incidents (43 percent of total) took place during 1994. Outside this abnormality, the average value is right around 10 incidents per year. The cause(s) of the excessive 1994 value remains unknown but would be worthy of attention at the local level.

I-65 Corridor in Jefferson County

Hazardous Material Incidents, 1991-95

MSD Database



Incidents by Years

1991	13
1992	10
1993	10
1994	32
1995	9

Statistics

Total number of Incidents 1991-95	74
Total Amount Spilled	3105.2 gal.
Average Amount Spilled per Incident	41.96 gal.

Figure 2-10

CHAPTER THREE
ANALYSIS OF THE I-65 PLACARD SURVEY

Field observation of truck movements within the I-65 corridor commenced in April of 1996 and concluded in July of 1996. A total of 600 observational hours were logged by two paid observers with experience in previous corridor studies. These 600 observational hours were systematically distributed so that regional and temporal comparisons, e.g., day of week and time of day, can be made. This provides ability to reveal any space/time patterns that might underlie the data. Please note that a minimum of 30 observational hours forms the basis for any comparative category used in the results reported here.

During these 600 hours of observation, a total of 127,198 trucks were evaluated for possible carriage of hazardous material as indicated by the absence/presence of the required U.S.D.O.T. placard and material ID number. Of these 127,198 trucks, 3,330 (2.6 percent) were found to be carrying placarded quantities of hazardous materials. The location, date, day of week, time of day, and material carried was noted for each of these placarded trucks. Observation locations are indicated in Figure 1-2 and their associated statistics are used to represent truck flows: (a.) entering Louisville from the north (Clarksville) on I-65, (b.) passing through the downtown Louisville area on I-65 (near Arthur St.), (c.) in the central region of the I-65 corridor (Elizabethtown), and (d.) in the southern region of the I-65 corridor (Franklin). These are real flow data that are fully capable of representing the number of trucks and the number of hazmats passing a given point in a given hour (or other standard unit of time as defined).

3.1 Aggregate Truck Frequencies in the I-65 Corridor

During the 600 hours of field observation that were accomplished, and as mentioned above, 3,330 hazmats were recorded among a total truck count of 127,198 (2.6 percent). On average, if a person were to stand aside I-65 and count the number of trucks passing by, he/she would see 212 trucks per hour or 5,090 per 24 hour period (see Figures 3-1 and 3-2). During that same time period and on average, that person would see nearly 6 (5.6) placarded trucks per hour carrying at least one type of hazardous material, i.e., 135 hazmats per day. Since the average total vehicular traffic (cars, buses, trucks, etc.) on I-65 is approximately 1,700 vehicles per hour, or 41,000 vehicles per day, trucks comprise about 12.5 percent of total traffic and placarded trucks, i.e., hazmats, comprise about 0.35 percent of total traffic on I-65. The northbound and southbound lanes of I-65 provide nearly equal total truck frequencies across all observational locations. Northbound lanes do supply slightly greater frequencies (nearly 10 percent greater) of hazmats than do the southbound lanes. This distinction is somewhat larger outside the Louisville region.

Like most average values, those reported above tend to mask some of the very important variation that actually characterizes flows in the I-65 corridor. For instance, there are differences that are both interesting and significant, from the emergency response planning perspective, that distinguish flows in the various regions that make up the corridor. We will place most of our focus on differences between the Louisville region (north) and the southern portion of the

HOURLY TRUCK FREQUENCY IN THE I-65 CORRIDOR

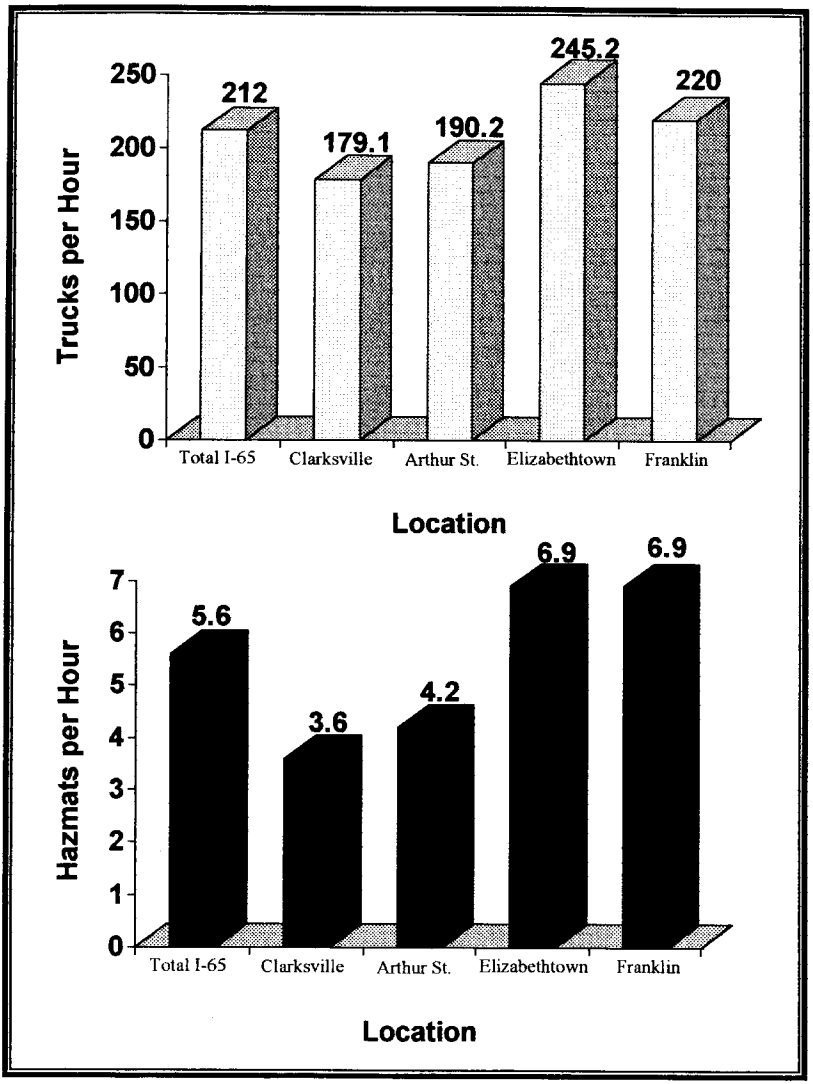


Figure 3-1

corridor.

First, total truck traffic varies considerably in the corridor (see Figures 3-1 and 3-2). Although the average is 212 trucks per hour, this value ranges from a low (in north Louisville) of 179 to a high (in Elizabethtown) of 245. This represents a 37 percent difference between minimum and maximum. When aggregated, the Louisville locations provide 185 trucks per hour while the southern observation locations (Elizabethtown and Franklin) provide 233 trucks per hour. This variation of 48 trucks per hour represents a 26 percent difference. Please recall that the average hazmat frequency in the I-65 corridor is 5.6 hazmats per hour. However, the Louisville frequencies are substantially lower (3.9 hazmats per hour in the aggregate) than the southern frequencies (6.9 hazmats per hour). This represents a very significant difference in hazmat densities in general. Southern hazmat flows are 77 percent larger than they are in the Louisville region. In Louisville, about 2.1 percent of all trucks are hazmats while 3.0 percent of the trucks traveling through the more southerly regions are hazmats. So, not only is the absolute number of hazmats traveling over the southern stretch larger than the Louisville region (by 3 hazmats per hour) but the relative density of hazmats is also higher (by 0.9 percentage points). Although these differences might not seem substantial at initial glance, the reader is reminded that these differences do yield an estimated 7.6 million hazmat miles per year outside Jefferson County (on I-65) and 0.5 million hazmat miles inside Jefferson County (on I-65), a ratio of 15 to one.

It is in the light of this last comparison that Jefferson's hazmat incident rate (recorded over the past five years) is so amazingly large. Within the I-65 corridor, Jefferson County accounts for roughly six percent of the total hazmat vehicle miles driven within the corridor but accounts for 73 percent of the corridor's hazmat incidents.

Hazmat frequencies are modestly higher on northbound lanes (5.8 hazmats per hour) than they are on southbound lanes (5.3 hazmats per hour), a nine percent difference. This distinction between north and south is larger in the south than it is in the Louisville region. The highest hazmat frequencies are encountered on the northbound lane south of Louisville. The smallest hazmat frequencies are encountered on the southbound lane north of Louisville (in Clarksville). These differences are quite large and are of obvious importance in the planning process.

It can be deduced from these frequencies that central Louisville is avoided by trucks in general as they head north. Most use I-265 to gain access to I-64 east and I-71 north. When headed west on I-64, trucks use I-264 west as they leave I-65 northbound. The relative diversion of northbound hazmats on I-65 around central Louisville is even more pronounced than it is for trucks in general. Truck flows in general are 26 percent less through Louisville than traffic coming into the region (thus making use of I-264 and I-265). Hazmat flows are 79 percent less. The more exact nature of this diversion awaits future field observation and analysis of the circumferential interstate segments (I-264 and I-265), I-71, and I-64 (west of the city). I-64 just east of the city has already been analyzed. In summary of those findings, 8.8 hazmats per hour are headed toward Louisville (westbound) while 9.7 hazmats per hour are headed from the city (eastbound). By summing hazmat frequencies on I-65 headed into Louisville form the north, I-65 headed into Louisville from the south, and I-64 headed into Louisville from the east, it can be estimated that 19 hazmats per hour are entering the Louisville region from those directions.

HOURLY TRUCK FREQUENCY NORTHBOUND VS. SOUTHBOUND IN THE I-65 CORRIDOR

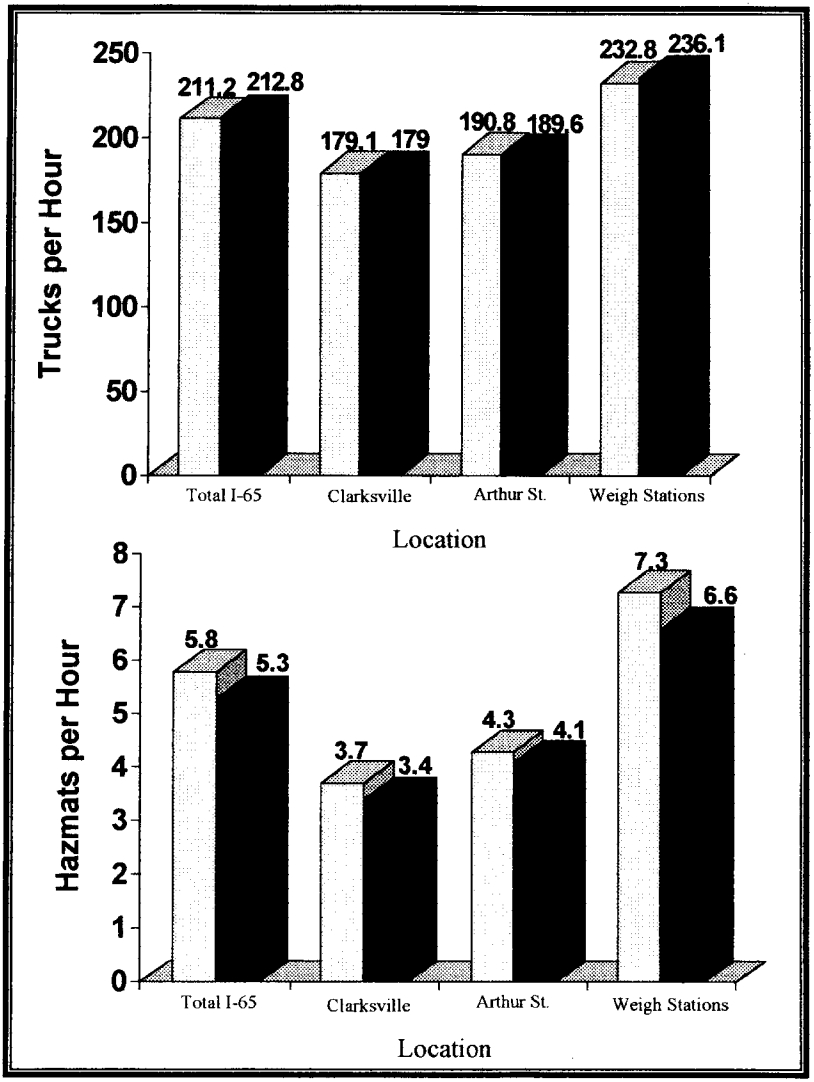


Figure 3-2

3.2 Truck Frequencies by Day of the Week

Observational hours were spread systematically over days of the week in order to facilitate comparisons within the normal work week (Monday through Friday) and between the work week and the weekend. Figures 3-3 and 3-4 help to summarize the general truck and hazmat frequencies, by day of the week.

Within the entirety of the I-65 corridor, total truck frequencies range from a low value of 128 per hour on Sunday to a maximum of 254 trucks per hour, which occurs on Tuesday and Thursday. This is a ratio of nearly 2 to 1. The average for the weekend in general is approximately 144 trucks per hour while the typical work day produces traffic of 239 trucks per hour, a rate that is 66 percent higher than the weekend rate. Mondays provide a substantially smaller truck frequency within the I-65 corridor (212 trucks per hour) than any other weekday. Once again, these differences in daily truck frequencies should play a role in strategic emergency response planning. Some of these aspects will be more closely examined in Chapter 5.

Hazmat frequencies, by day of the week, parallel the general truck traffic pattern in the I-65 corridor. However, although Tuesdays and Thursdays provide peak total truck movements, it is Wednesday that provides the peak hazmat frequency (8.0 hazmats per hour). The Wednesday hazmat peak is nearly four times larger than the Sunday hazmat lull (only 2.4 hazmats per hour) within the I-65 corridor. Mondays and Fridays present work week lulls. The Friday lull is 54 percent less than the Wednesday peak. The weekend lull in hazmat movements is disproportionately less than the lull in general truck traffic.

A few differences do distinguish the Louisville region from the remainder of the I-65 corridor in terms of truck and hazmat flows assembled by day of the week (see Figure 3-4). In terms of general truck movements, Louisville flows exceed the others' on Tuesday through Friday. There are higher frequencies to the south on the weekends and on Monday. Louisville flows reach their peak on Tuesday while southern flows peak on Thursday. The weekend lull in Louisville is more pronounced than it is in more southerly regions of the corridor. The Sunday lull in Louisville is only 45 percent of the Tuesday peak. In the south, the Sunday lull is 54 percent of the Thursday peak.

Hazmat flows vary significantly by day between locations. Hazmats flows experience a modest peak (6.9 hazmats per hour) on Tuesdays in the Louisville region while they peak on Wednesdays (8.1 hazmats per hour) outside Louisville (to the south on I-65). Louisville does experience a relatively large flow of Friday hazmats. This is the only day of the week in which the Louisville region's hazmat frequency surpasses that found in the remainder of the I-65 corridor. At least in relative terms the excess of hazmats in the south during the weekend is quite pronounced; Sunday hazmat flows in the south are 74 percent larger than Louisville's.

3.3 Truck Frequencies by Time of Day

Traffic congestion and density are major concerns when attempting to anticipate incidents

DAILY TRUCK FREQUENCY IN THE I-65 CORRIDOR

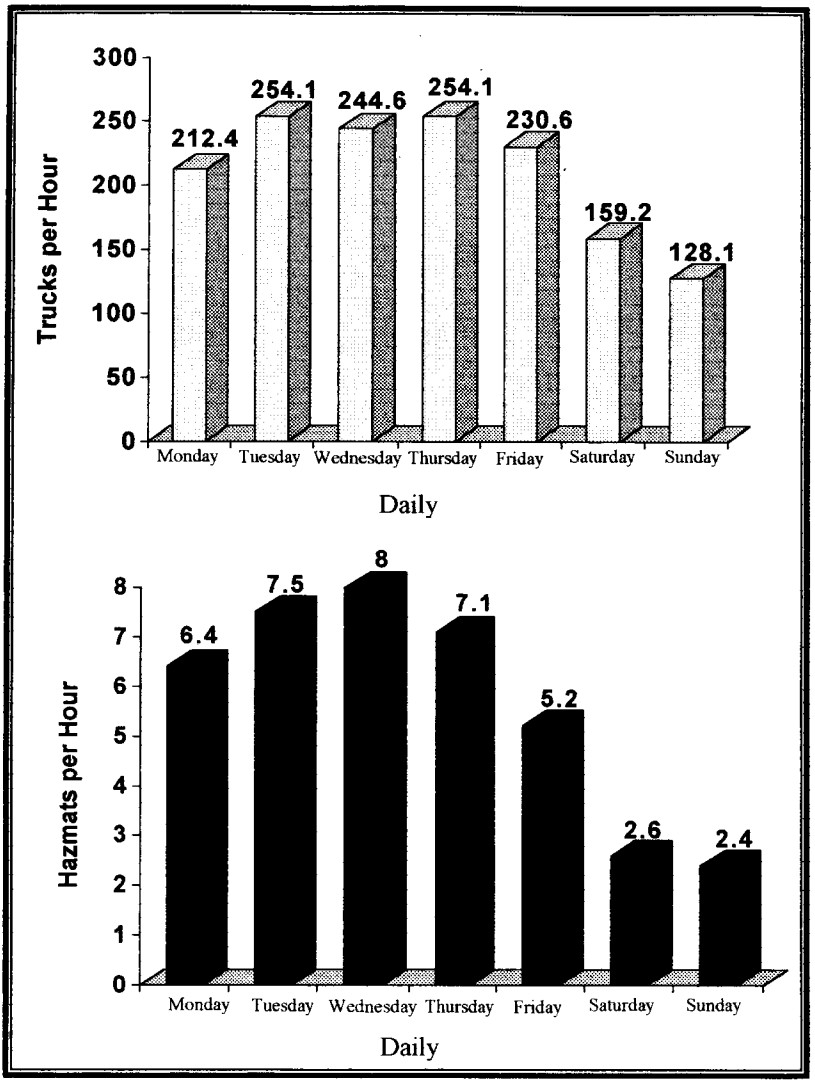
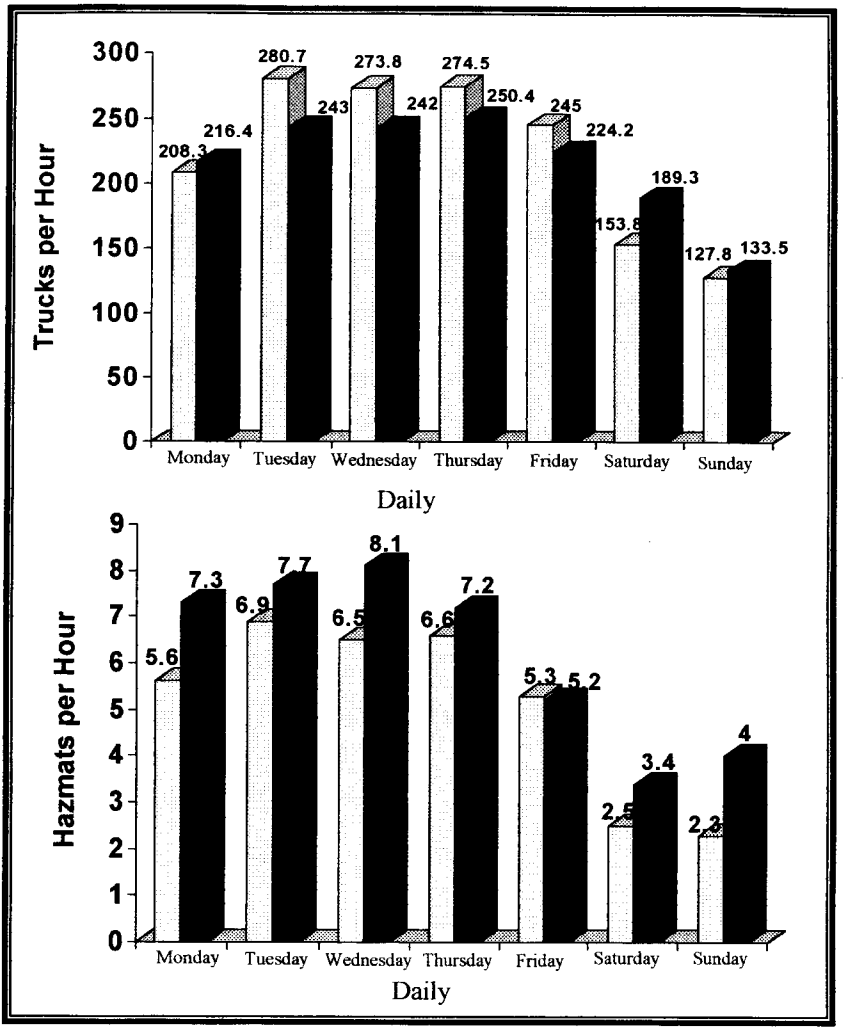


Figure 3-3

HOURLY TRUCK FREQUENCY, BY DAY OF THE WEEK



Louisville Region: Observation Points, 1,2,3,4

Weigh Stations: Observation Points, 5,6,7,8

Figure 3-4

involving the transportation of hazardous materials. All else being equal, most citizens would agree that it is preferable for hazmats to avoid movements when (and where) general traffic densities (congestion) are highest, e.g., morning "rush hour" traffic. The probability of traffic accidents obviously increases as the density of vehicles, at a given highway design capacity, increases. Accessing incident sites with emergency personnel and equipment is also problematic during peak traffic periods.

For purposes of this study, the 24 hour day is divided into five time periods. They are:

Period 1 (Morning Peak),	7 a.m. to 10 a.m.
Period 2 (Midday),	10 a.m. to 4 p.m.
Period 3 (Evening Peak),	4 p.m. to 7 p.m.
Period 4 (Early Night),	7 p.m. to 11 p.m.
Period 5 (Late Night),	11 p.m. to 7 a.m.

Figures 3-5 and 3-6 summarize general truck and hazmat flows by time of day, as defined above. Peak truck movements in the general case for the I-65 corridor occur during the midday period (10 a.m. to 4 p.m.) when 233 trucks per hour are witnessed. Truck flows decrease gradually as the peak passes. Minimum flows are experienced during the late night period (12 to 6 a.m.) when 172 trucks per hour are observed. Although truck frequencies during the evening peak are quite large (226 trucks per hour), the frequency during the morning peak is substantially less (199 trucks per hour). There does seem to be some effort on the part of truckers to avoid the congestion associated with the more concentrated morning peak (7-10 a.m.).

Hazmat frequencies are distributed a little bit differently across time periods than are trucks in general. Peak hazmat frequencies (6.5 hazmats per hour) are still observed during the midday period (11 a.m. to 4 p.m.). However, whereas the late night lull for general trucking is 74 percent of the midday peak, the late night lull for hazmats is only 52 percent of the midday peak, a much more pronounced late night lull for hazmat traffic. Additionally, the morning peak period (7-10 a.m.) provides the second highest hazmat frequency (5.9 hazmats per hour). This is substantially different from the general truck flow pattern. There is far less effort to avoid morning traffic congestion on the part of hazmats than was seen with general trucking. This seems somewhat problematic and presents a greater challenge to emergency response personnel than would other temporal configurations of hazmat movements. The midday hazmat peak (6.5 per hour) is nearly twice as great as the late night lull (3.4 per hour).

As was seen in previous sections, there tend to be spatial differences in temporal patterns within the I-65 corridor. In terms of the daily timing of movements for general trucking and hazmat movements in particular, there are also some noteworthy differences between locations. Louisville truck flows occur earlier in the day than do truck movements in the south. The peak period in the Louisville region (217 trucks per hour) occurs during the midday period (10 a.m. to 4 p.m.) with a systematic decline in frequencies as the day progresses. The late night lull in Louisville (139 trucks per hour) is more pronounced than it is in the southern portions of the corridor. The late night frequency in Louisville is only 64 percent of the midday peak. In the rest of the corridor, the peak truck frequencies (264 trucks per hour) are recorded during the

HOURLY TRUCK FREQUENCY IN THE I-65 CORRIDOR, BY TIME OF DAY

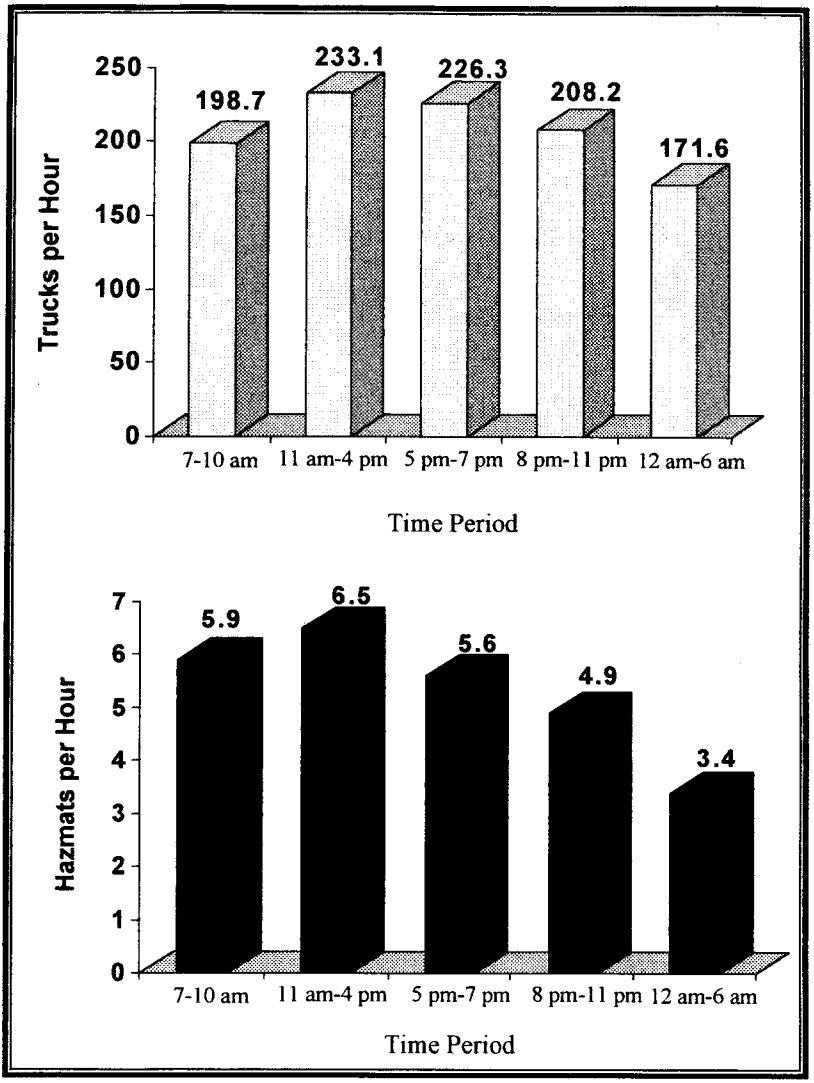
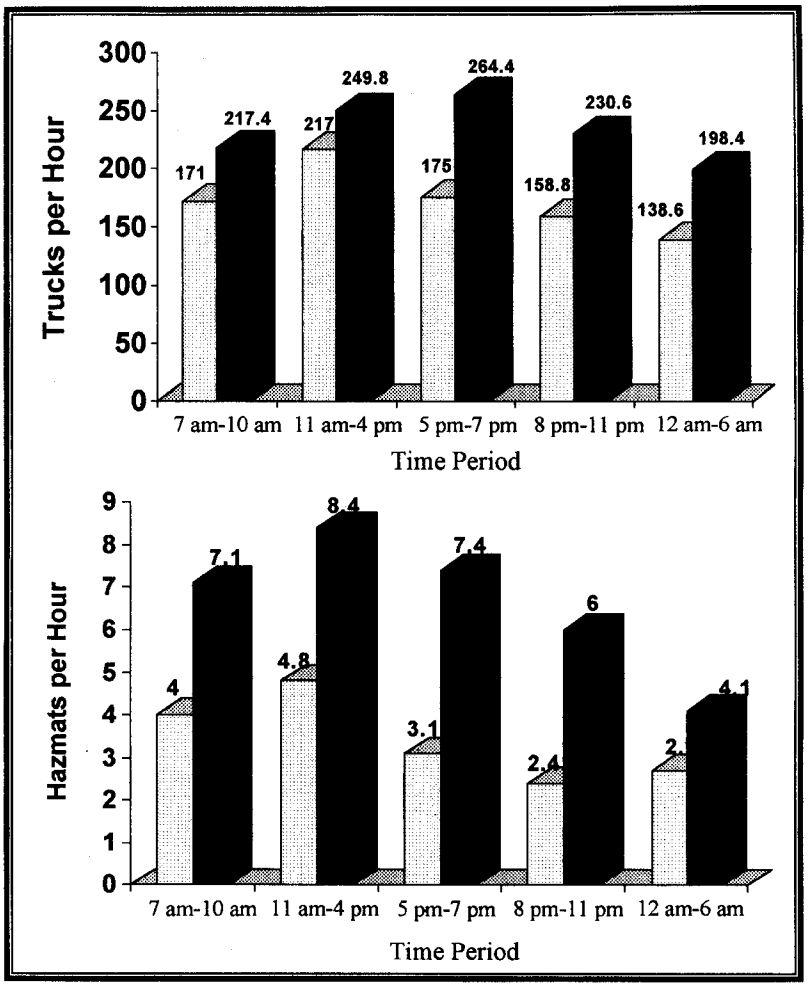


Figure 3-5

HOURLY TRUCK FREQUENCY, BY TIME OF DAY



Louisville Region: Observation Points, 1,2,3,4
Weigh Stations: Observation Points, 5,6,7,8

Figure 3-6

evening peak traffic period (4-7 p.m.). The late night lull (198 trucks per hour) is less pronounced at 75 percent of the early evening peak.

Differences in timing of hazmat movements between Louisville and the rest of the I-65 corridor are also substantial. The southern portion of the corridor experiences a rather dramatic peak of activity (8.4 hazmats per hour) during the midday (10 a.m.-4 p.m.) period. There is a steep decline in frequencies after this midday peak is reached in the south. The late night hazmat lull outside Louisville (4.1 hazmats per hour) is less than half of the midday peak. The temporal distribution of hazmat movements in Louisville is not quite so peaked. The late night lull in hazmat movements is not nearly so pronounced as it was in the south. In fact, the early night hazmat frequency (2.4 hazmats per hour) is actually less than the late night frequency (2.7 hazmats per hour), which is quite uncommon. Also noteworthy is the fact that the second highest hazmat frequencies (4.0 hazmats per hour) in the Louisville region are found during the morning peak period (7-10 a.m.). However, regardless of time period chosen hazmat frequencies are substantially higher in the southern portions of the corridor than they are in the Louisville region.

3.4 Composition of Hazardous Materials Being Transported

During the 600 hours of field observation within the I-65 corridor, placard information was carefully recorded in all cases. This information is known for each of the 3,330 hazmats that passed by the points of observation. Note that some placards indicate only the general nature of the material contained in the shipment. In such cases, generic descriptions such as "Flammable Gas", "Corrosive", or "Poison" are indicated. In the analyses which follow, each placard type is treated separately, as though the material is unique when in fact several of the placard categories are not mutually exclusive. A given hazardous material could be labeled using one of several different placard designations. The intent remains to preserve as much of the detail about material composition as possible while maintaining validity.

Figures 3-7 and 3-8 are used here to summarize key information about the relative composition of hazardous materials moving along the I-65 corridor. A total of 233 different placard categories were observed over the course of the 600 observational hours (see Table 3-1). Since several of these placard descriptors are general in nature and could be used to represent the transportation of a number of different materials, the actual number of different materials is unknown but probably approaches 275 in the Kentucky portion of I-65. It is also true that it takes longer hours of observation to record rare hazmat movements so that these types are also absent from this database. This omission involves a small number of hazardous materials however.

The most frequent hazardous material category generally encountered within the I-65 corridor is placard 1203 (gasoline). This single category represents approximately 21 percent of total placarded movements within the corridor. The hourly frequency of placard 1203 exceeds one per hour (1.19 per hour) on I-65. The second most observed placard category is "Flammable Liquid" with roughly 12 percent of the total recorded. Much of this category, although unknown, also

COMPOSITION OF HAZARDOUS MATERIALS TRANSPORTED IN THE I-65 CORRIDOR

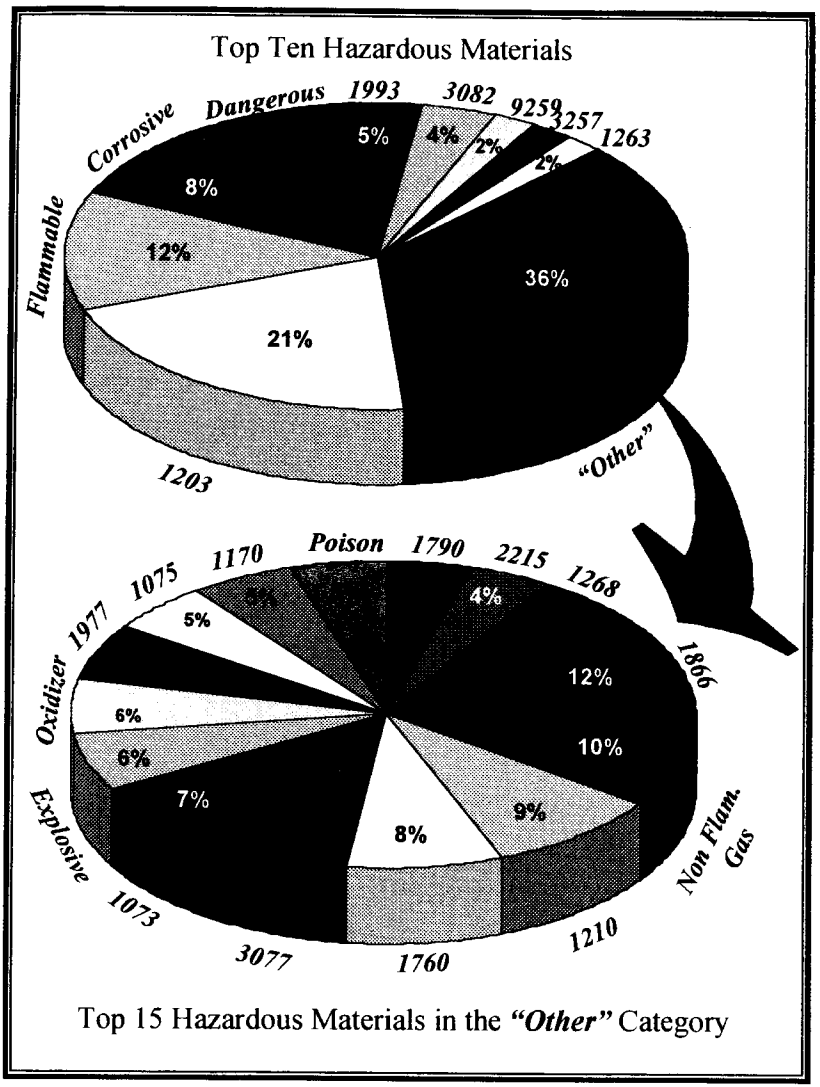


Figure 3-7

COMPOSITION OF HAZARDOUS MATERIALS TRANSPORTED ALONG THE I-65 CORRIDOR

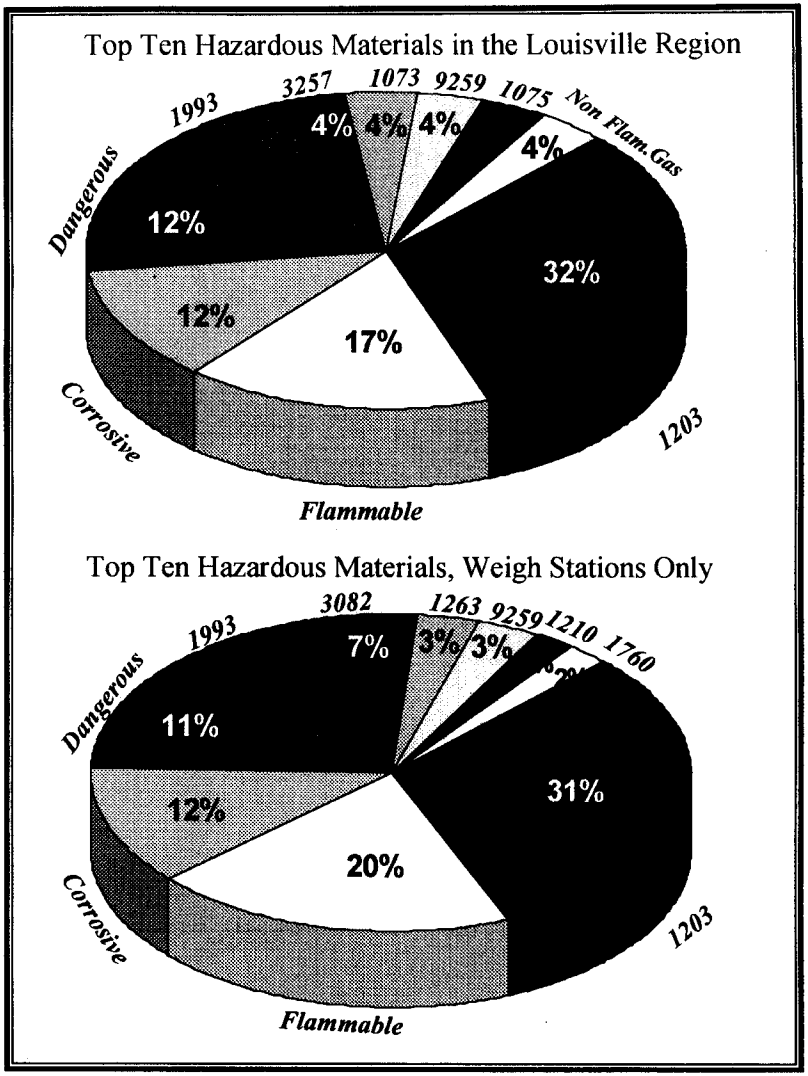


Figure 3-8

Table 3-1

U.S.D.O.T. MATERIAL IDENTIFICATION NUMBERS
OBSERVED IN THE I-65 CORRIDOR

Explosive "all classes"	1170	1693	2014	2810
Corrosive	1173	1710	2031	2874
Flammable	1175	1715	2037	2920
Non Flammable Gas	1188	1719	2051	2922
Bio-Hazard	1193	1736	2055	2924
Radioactive	1196	1750	2056	2929
Dangerous when wet	1199	1754	2074	2965
Dangerous	1203	1756	2076	2966
Oxidizer 5.1	1204	1760	2078	2970
Blasting Agent 1,1.5	1206	1763	2079	3020
Flammable Solid	1208	1766	2185	3051
Flammable Gas	1210	1780	2187	3052
Poison	1214	1783	2201	3057
Oxygen 2	1216	1784	2210	3065
Organic Peroxide	1218	1788	2212	3066
Harmful keep away from food	1219	1789	2215	3072
Combustible	1230	1790	2218	3076
1002	1234	1793	2252	3077
1005	1242	1803	2254	3082
1014	1245	1805	2259	3108
1015	1247	1809	2264	3109
1016	1255	1814	2265	3145
1017	1256	1819	2282	3157
1018	1262	1824	2290	3159
1026	1263	1830	2315	3190
1030	1264	1832	2345	3256
1032	1265	1838	2370	3257
1038	1268	1840	2375	3258
1046	1270	1851	2426	3259
1048	1274	1858	2444	3262
1049	1279	1859	2491	3264
1052	1282	1860	2527	3265
1053	1293	1863	2531	3266
1061	1294	1866	2541	3267
1062	1296	1888	2582	3280
1063	1303	1897	2584	3295
1073	1305	1910	2618	9259
1075	1307	1917	2651	
1076	1366	1940	2666	
1083	1369	1951	2672	
1090	1402	1955	2689	
1093	1408	1956	2693	
1100	1450	1958	2715	
1120	1482	1966	2734	
1123	1584	1977	2735	
1133	1593	1987	2789	
1135	1648	1992	2796	
1158	1687	1993	2798	
1160	1689	1999	2801	

includes gasoline shipments. Clearly, training should provide adequate attention to dealing with this prevalent (and very dangerous) hazardous material and appropriate response to its accidental release. The hourly flow rate for the "Flammable" placard is 0.71 movements per hour. So, an observer would expect to see at least 4 "Flammable" shipments per six hour period on I-65. Placard categories "Corrosive" and "Dangerous" are the next most frequent and each provides about eight percent of total placarded shipments on I-65. They each yield flow rates of approximately 0.45 shipments per hour. Other frequently observed placard categories/materials (rounding out the top 25 by frequency of observation) along with their hourly frequencies are:

1993 (diesel), 0.30/hr
3082 (liquid haz. waste), 0.22/hr
9259 (hot liquid), 0.14/hr
3257 (hot liquid), 0.12/hr
1263 (paint), 0.11/hr
1866 (resin), 0.11/hr
"Nonflammable Gas", 0.09/hr
1210 (ink), 0.08/hr
1760 (liquid acid), 0.07/hr
3077 (solid haz. waste), 0.07/hr
1073 (liquid oxygen), 0.06/hr
"Explosive" (all classes), 0.05/hr
"Oxidizer", 0.05/hr
1977 (liquid nitrogen), 0.05/hr
1075 (LPG), 0.05/hr
1170 (alcohol), 0.05/hr
"Poison", 0.05/hr
1790 (flouric acid), 0.04/hr
2215 (maleic acid), 0.04/hr
1268 (petroleum distillate), 0.03/hr.

As was mentioned earlier, the southern portions of the I-65 corridor have more truck traffic in general, more hazmat traffic in particular, and now it is determined that the southern regions also witnesses a significantly greater variety of hazardous materials moving through their jurisdictions. For instance, the Louisville region witnessed 103 different placard categories in the northern part of the corridor. The southern portion of the corridor provided 187 different placard categories, 82 percent more variety in the south than seen in Louisville. This level of material variety poses a very significant challenge to emergency response planners, especially in the southern portion of the corridor. Figure 3-8 details other differences found in the composition of hazardous material truck shipments between the Louisville and the southern region. Louisville and the south each witness about one-third of all placards in the 1203 category. The dominance of this category of material throughout the corridor is noteworthy.

The top 5 placards, in terms of frequency of observation, are identical for the two regions:

	Louisville	Southern Regions
1. 1203 (gasoline)	32%	31%
2. "Flammable"	17%	20%
3. "Corrosive"	12%	12%
4. "Dangerous"	12%	11%
5. 1993	9%	7%.

This level of locational similarity in material composition within the I-65 corridor is actually quite remarkable and was not exhibited in other corridors studied to date (I-64, I-75). After this commonality, however, differences do emerge. In the Louisville region, we see significantly more: 3257 and 9259 (hot liquids), 1073 (liquid oxygen), 1075 (LPG), and Nonflammable gases. In the southern regions of the corridor, we see significantly more: 3082 (liquid hazardous waste), 1263 (paint), 1210 (ink), and 1760 (liquid acids). Emergency response planners should note the existence of these regional movement patterns and tailor plans, e.g., personnel training, accordingly.

Frequencies of occurrence that are of lesser intensity but which exhibit significant regional biases are also important to note from the planning perspective. Certain categories are simply seen more frequently in one area than the others and this is important to document. Regionally biased flows include the following.

Louisville Region:

"Flammable Gas"	1093	1204	1214
1274	1279	1710	1910
2056	2582	2689	3266

Southern Regions:

"Blasting Agents"	1247	1268	1402
"Organic Peroxide"	1790	1819	1824
"Oxidizers"	1866	1977	2031
"Poison"	2187	3077	3159
	3259	3265	3267.

3.5 Placard Survey Results and the USDOT Response Guides

As mentioned earlier, U.S.D.O.T. has developed basic descriptions of appropriate initial responses to incidents involving each of the placard categories. It is known that several different materials might be assigned to the same Guide Number if the required response to their release is indeed similar. Guide Numbers range from 111 to 172. Each of the 233 different placard

categories observed in the I-65 corridor was assigned the corresponding Guide Number each time that it appeared in the database of 3,330 placarded trucks. The reader is reminded that some trucks carry more than one hazardous material so that the total number of placards observed actually slightly exceeds 3,330. By assessing the frequency of each placard category, we can estimate the relative frequency of appropriate responses, i.e., especially those most needed. This process, of course, assumes that hazmat incidents involving any particular type of material will occur in direct proportion to our estimate of its presence in the I-65 corridor.

Figures 3-9 and 3-10 indicate the relative occurrence of required responses (Guide Numbers) derived directly from the relative frequencies of placard categories (hazardous materials) observed in the I-65 corridor. Guide Number 128, for instance, accounts for a full third (33 percent) of all estimated required responses. Other important, i.e., frequently occurring, Guide Numbers for hazmat traffic in the I-65 corridor are: 127, 153, 111, and 171 (each above 5 percent). Each of these accounts for at least five percent of estimated required responses. Note that Response Guides 128 and 127 alone, account for over half of all estimated required responses. If the average year produces 110 total incidents within the I-65 corridor, as has been the case for the previous five years, then we would expect about 36 incidents requiring use of Guide Number 128.

Given minor differences in dominant hazardous materials transported along I-65 segments in Louisville and the southern regions of the corridor, large differences in required response distributions would not be expected (see Figure 3-10). The rank order for the required response Guide Numbers align perfectly over the top four spots:

Guide Number	Louisville	Southern Regions
128	35%	32%
127	18%	19%
153	10%	12%
111	8%	7%.

Guide Numbers 122, 121, and 115 are relatively more important in the Louisville region while Guide Numbers 171, 129, and 120 are relatively more important in the southern I-65 regions. These distinctions are crucial to the design of efficient training programs. Although other differences do exist, they are far less substantial than those mentioned here and may arise simply as a result of random occurrences which should not form the basis of planning efforts.

RESPONSES TO HAZARDOUS MATERIAL TRANSPORTED IN THE I-65 CORRIDOR

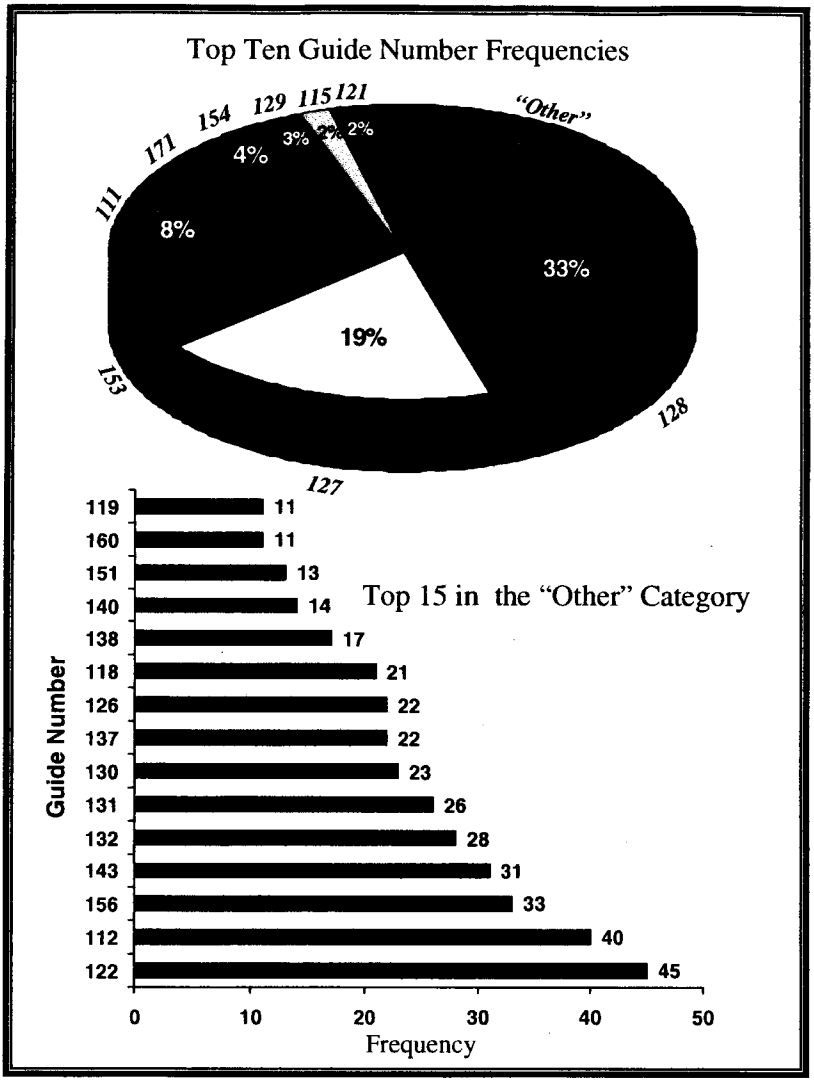


Figure 3-9

REGIONAL GUIDE RESPONSES IN THE I-65 CORRIDOR

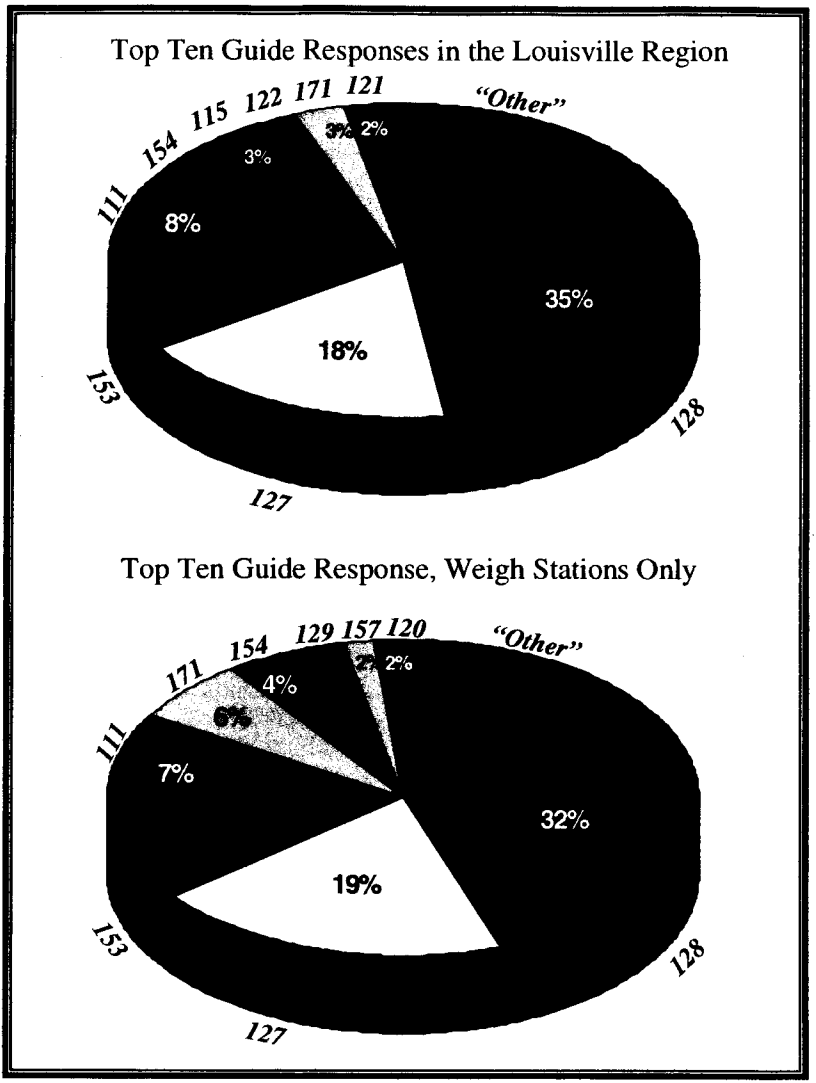


Figure 3-10

CHAPTER FOUR
FIXED FACILITIES IN THE I-65 CORRIDOR

There are 261 fixed facilities located within the nine counties of the I-65 corridor in Kentucky. These are monitored by the Kentucky Division of Disaster and Emergency Services because they store at least 500 pounds or exceed the threshold planning quantity of one or more of the EPA's Extremely Hazardous Substances. In order to maintain inventories of these materials, fixed facilities such as manufacturing plants, regional terminals and distributors, municipal water plants, and retail operations that serve agriculture, must receive shipments into (and in some cases out of) the facility. Proper plans for anticipating the timing and placement of transportation incidents involving hazardous materials should be based upon knowledge of fixed facilities' uses of (especially) trucking, although other modes of transportation are used, albeit less frequently.

In order to investigate the use of local roads, highways, and streets in moving hazardous materials to and from I-65 as well as the origins/destinations of hazmats interacting with fixed facilities within the corridor, a questionnaire was sent during June of 1996 to each of the 261 Tier I fixed facilities monitored by the Kentucky Division of Disaster and Emergency Services (see Figure 4-1). Information requested in the questionnaire deals with:

-Frequency of hazmat shipments
-Routing of hazmat shipments
-Total quantities of hazardous materials
-Origins/destinations of shipments.
-Timing of hazmat shipments
-Composition of hazmat shipments
-Recent trends

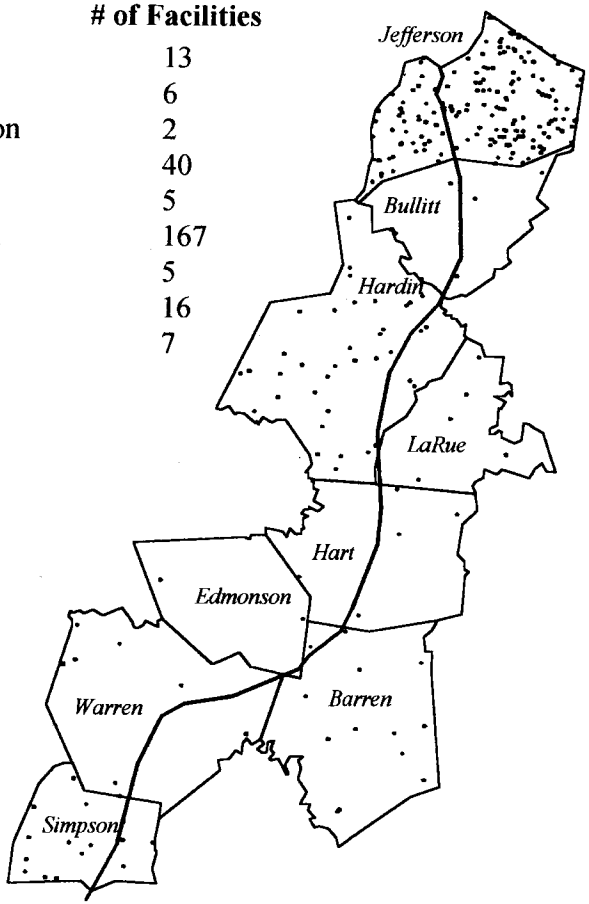
These data were assembled for the last complete year of data, i.e., the 1995 calendar year. Eighty one (81) usable questionnaires were returned. This represents a response rate of approximately 31 percent and this is more than adequate to portray the types of hazmat movements taking place at the more local scale. Inspection of the questionnaire returns indicates a wide variety of firms in terms of size and function which adds further support to the assumption of a representative sample.

4.1 Some Basic Survey Results

Figures 4-2a and 2b summarize the basic activity of responding firms in their transportation of hazardous materials (to and from the fixed facility) over the past five years, 1991 to 1995. Total hazmat transportation activity has increased in continuous fashion for facilities located within the corridor over the five years under review. Total hazmat volume increased by 51 percent for this sample of facilities. The average volume of hazardous materials shipped by a facility increased from about 77 thousand tons/facility in 1991 to 116 thousand tons/facility in 1995. These are substantial increases and exist in contrast to decreased volumes within the I-75 corridor. We should note here that Dow Corning in Elizabethtown produces shipments that dwarf the activities of other facilities in the corridor (compare Figures 4-2a and 2b). Their hazmat volumes increased from 6.02 million tons in 1991 to 9.18 million tons in 1995.

FIXED FACILITIES LOCATIONS ALONG THE I-65 CORRIDOR

County	# of Facilities
Barren	13
Bullitt	6
Edmonson	2
Hardin	40
Hart	5
Jefferson	167
LaRue	5
Simpson	16
Warren	7



One Dot = One Fixed Facility

Figure 4-1

TONS OF HAZARDOUS MATERIALS SHIPPED AND RECEIVED BY FIXED FACILITIES IN THE I-65 CORRIDOR

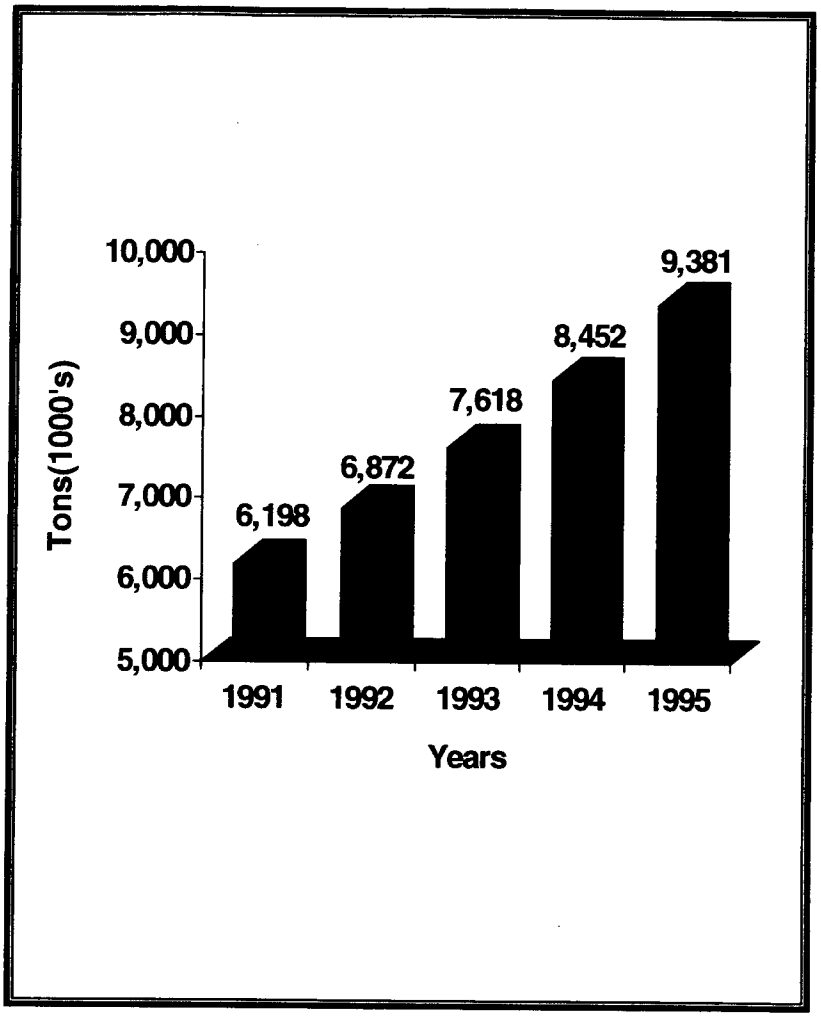


Figure 4-2a

TONS OF HAZARDOUS MATERIALS SHIPPED AND RECEIVED BY FIXED FACILITIES IN THE I-65 CORRIDOR

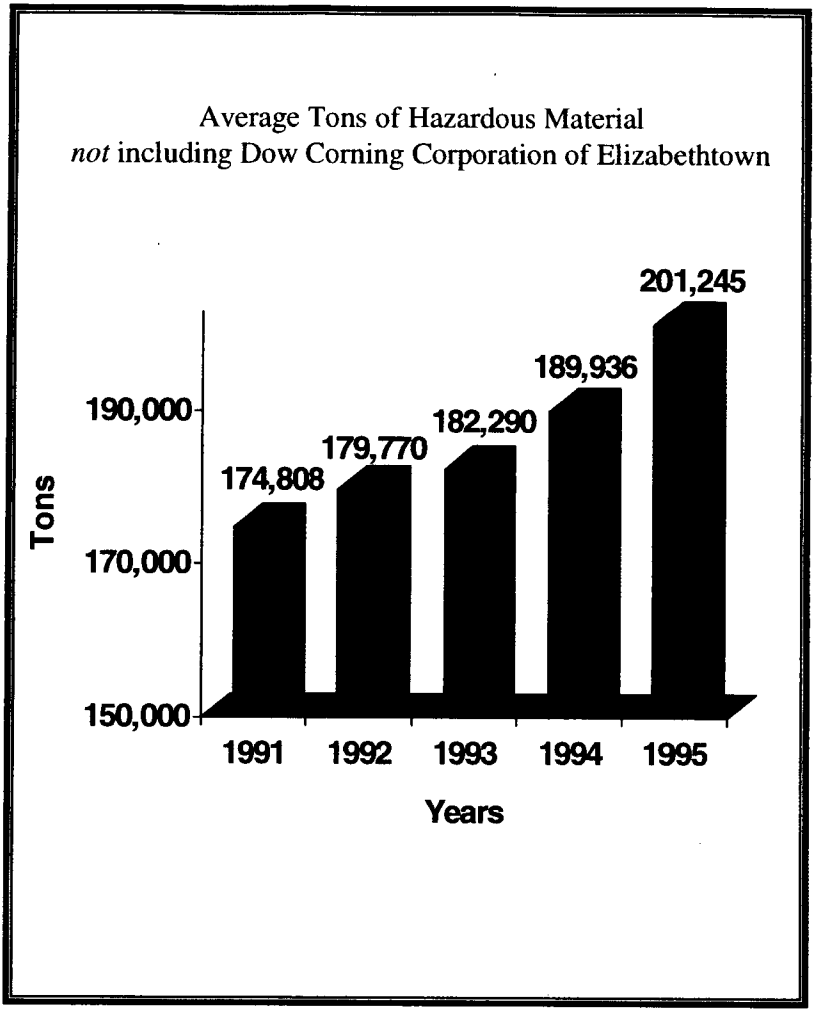


Figure 4-2b

These increased volumes (as recorded in Figures 4-2a and 2b and just described) involve movement by all modes of transportation including truck, rail, barge, and pipeline. Rail shipments are small in frequency (less than 3 percent of total shipments) but each shipment by rail tends to be large so that approximately 5 percent of hazmat volume moves into and out of the corridor's fixed facilities by rail. Ninety seven (97) percent of the facilities rely exclusively on truck shipments of hazardous material. Reporting facilities were responsible for generating a total of 16,721 hazmat truck movements in calendar year 1995. Thus the average fixed facility in the I-65 corridor is responsible for generating just over 206 hazmat movements per year. Extrapolating these sample results (81 fixed facilities) to the full set of 261 corridor fixed facilities, just under 54 thousand hazmat truck shipments were generated by the corridor's fixed facilities during 1995. Responding firms averaged just over 53,000 tons of hazardous material truck shipments into and out of their fixed facilities in 1995 (including Dow Corning). The average drops to 1,712 tons when Dow Corning is excluded from the analysis.

4.2 Space/Time Patterns

At the level of individual establishments, there are really few systematic patterns of hazmat truck movements detected through analysis of these survey results. However, a few notable features are indicated for completeness.

First, very few facilities (less than 3 percent) receive or send hazardous materials outside the normal M-F work week. Only 2.5 percent reported Saturday shipments as part of the normal routine and none reported shipments on Sunday as part of their normal routine. However, 21 percent of these facilities did report hazmat shipments (to or from the facility) on legal holidays, which is an important consideration for emergency response planners. In terms of the daily timing of hazmat truck shipments (both into and out of I-65 facilities), the following relative frequency distribution is noted:

Midnight to 6 a.m.	2.5 percent
6 a.m. to 9 a.m.	26.3 percent
9 a.m. to Noon	29.7 percent
Noon to 4 p.m.	32.2 percent
4 p.m. to 6 p.m.	7.6 percent
6 p.m. to Midnight	1.7 percent.

Please note that over one-third of all scheduled hazmat shipments to and from fixed facilities within the I-65 corridor occur during the morning (6-9 a.m.) or evening (4-6 p.m.) peak traffic periods. Shipments into facilities tend to be more frequent in the morning while shipments from the facility tend to be more frequent in the afternoon.

Facilities within the corridor exhibit expected patterns of origins and destinations for shipments of hazardous materials into and out of the facilities (see Figure 4-3). A substantial portion, 49 percent, are intrastate in nature (originating from within Kentucky or destined to places within Kentucky). About 33 percent of all hazmat movements stay within the corridor and represent

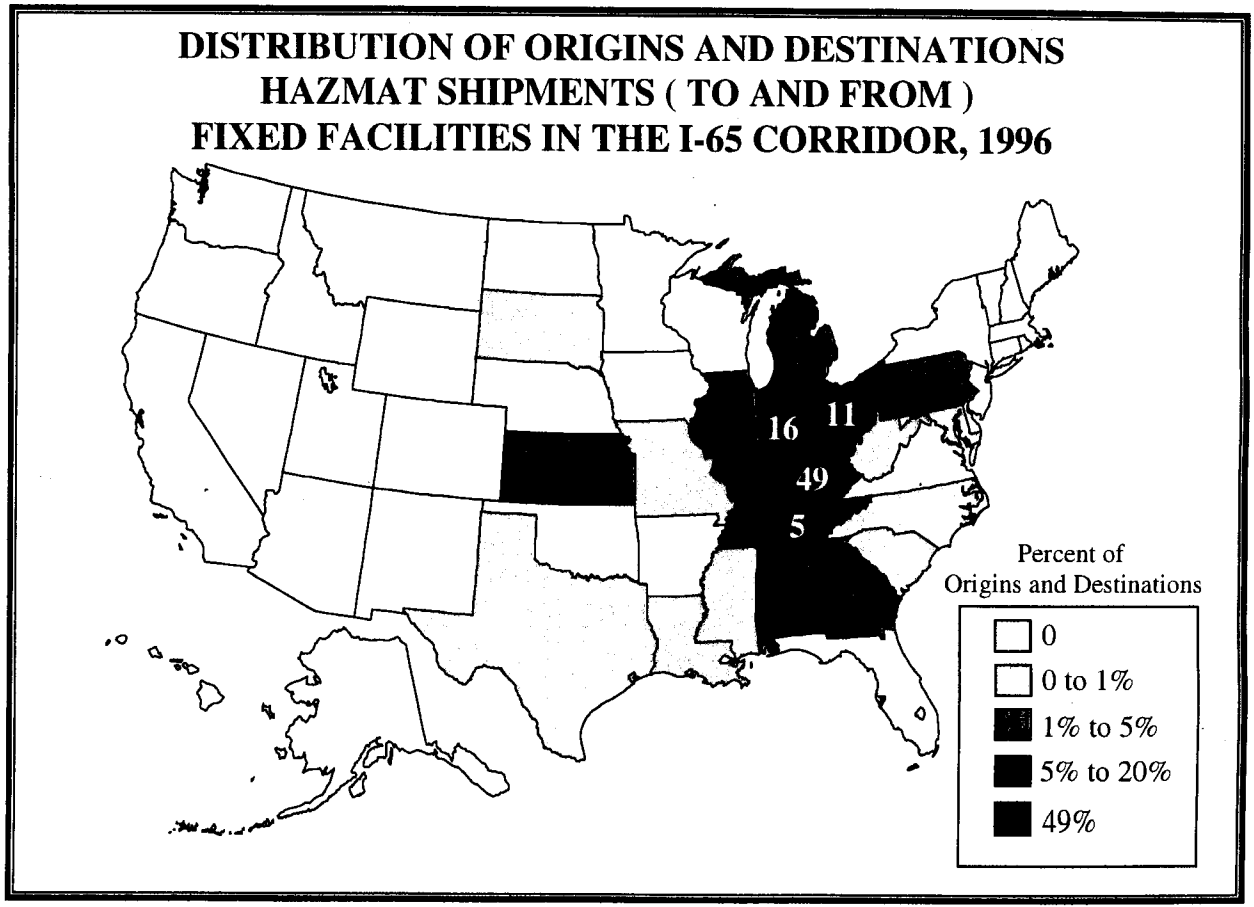

DISTRIBUTION OF ORIGINS AND DESTINATIONS
HAZMAT SHIPMENTS (TO AND FROM)
FIXED FACILITIES IN THE I-65 CORRIDOR, 1996
16
11
49
5
Percent of
Origins and Destinations
0
0 to 1%
1% to 5%
5% to 20%
49%

Figure 4-3

localized deliveries. However, I-65 is more interstate oriented than was the case for I-75 (where 56 percent of hazmat movements were intrastate). I-65 appears to be more strongly tied to the south in terms of the spatial interaction of hazmats. Tennessee, Alabama, and Georgia interact significantly with Kentucky's fixed facilities located in the I-65 corridor and more so than was the case with I-75. The most prominent city origin/destinations for I-65 fixed facilities in rank order are: Louisville, Cincinnati, Nashville, Lexington, Elizabethtown, Indianapolis and Chicago. Louisville serves as origin or destination for nearly 15 percent of all hazmat movements reported by respondents. With the exception of some long distance movements to (or from) Texas, Kansas, and South Dakota, hazmat truck movements appear to be limited to a range of approximately 400 to 500 miles. In the American economy, longer distance shipments tend to be larger volume and made by rail.

It is assuring to note that most local routes taken to access I-65 from fixed facilities are quite predictable and generally reflect a desire to accomplish the shortest time path (not necessarily shortest distance) between the fixed facility and the nearest I-65 interchange. Figure 4-4 summarizes these types of local access routes. A few fixed facilities, especially groups located in Jefferson, Edmonson, Hardin, and Barren, are located considerable distances from I-65 and thus require hazmat shipments over considerable distances through both urban and rural landscapes and an assortment of smaller communities. In the case of Jefferson County, the importance of I-265 (east of I-65) and The Gene Snyder Freeway (west of I-65) are visually apparent in Figure 4-4. A skeletal system of access is apparent with ribs extending from the I-265 and Gene Snyder spinal column.

4.3 Composition of Hazmat Shipments to and from Fixed Facilities

The questionnaire was designed to elicit information about the five most frequently shipped hazardous materials to and from fixed facilities within the I-65 corridor. The 81 respondents listed a total of 73 different hazardous materials being transported during 1995. This is more than three times more variety than was reported by facilities in the I-75 corridor. The number of different materials indicated by each facility is distributed as follows:

Number of Hazardous Materials Transported	Percent of Fixed Facilities
0	17
1	33
2	15
3	6
4	2
5 or more	26

Thus, the average number of hazardous materials being shipped from or received by any single

HAZARDOUS MATERIAL ROUTES (TO AND FROM) FIXED FACILITIES IN THE I-65 CORRIDOR

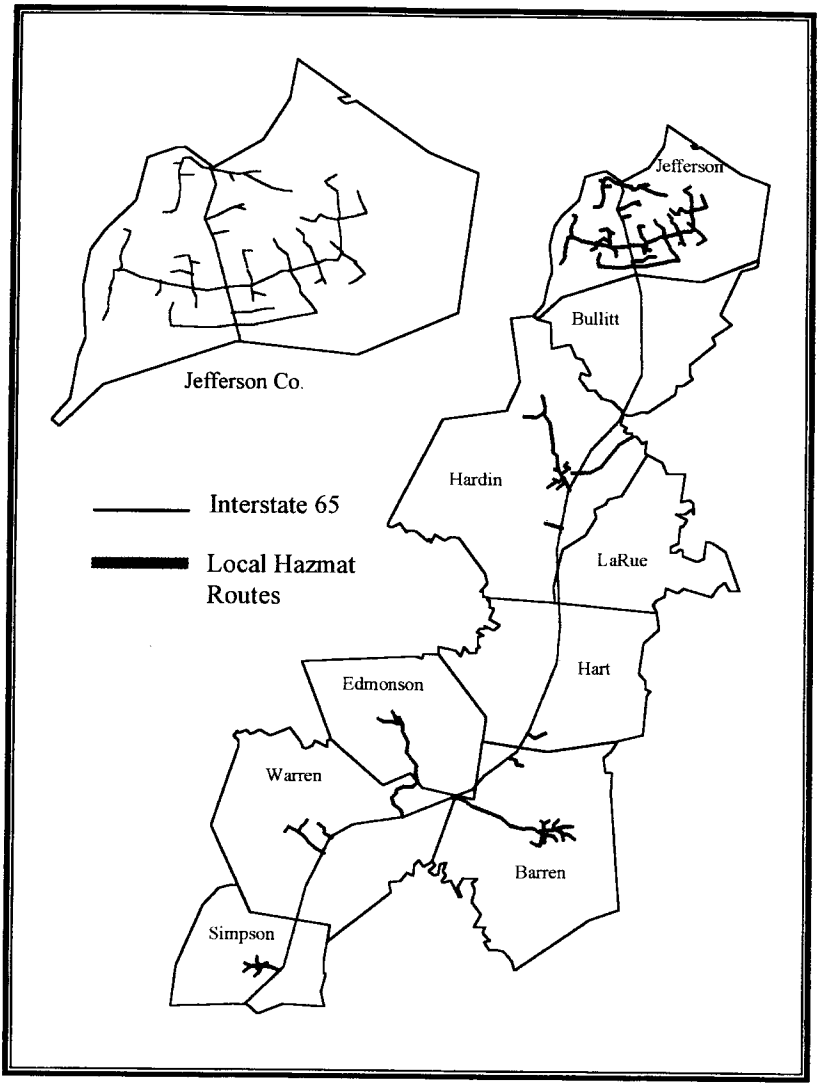


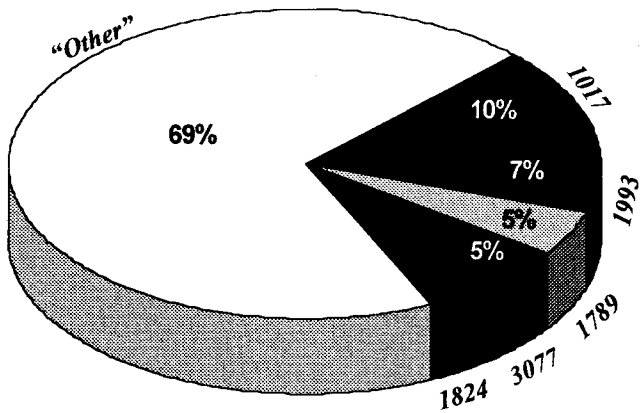
Figure 4-4

fixed facility in the I-65 corridor is 2.2. It is clear to most that the complexity of emergency response planning grows exponentially with the number of different materials present during transportation or nontransportation incidents. The fact that one-fourth of all fixed facilities deal in at least five different materials is very significant.

Figure 4-5 provides summary of the most frequently transported hazardous materials on local roads as they access fixed facilities to and from I-65. The most frequently encountered hazardous material witnessed on local roads connecting with I-65 is chlorine (Placard 1017). This is true in all corridors studied to date. This result aligns in direct proportion to the number of municipal water and sewer systems found within the corridor. Although not a prevalent material out on I-65 when compared to other materials moving up and down the interstate system, the local density of chlorine movements is noteworthy for local emergency planners. Combustible liquids (1993) are the next most commonly moved hazardous materials by the corridor's fixed facilities. Hydrochloric acid (1789), hazardous solid wastes (3077), and caustic soda (1824) are all prevalent in these local movements to and from the corridor's fixed facilities. With the exception of the hazardous waste category, this composition is remarkably similar to that found in the I-75 corridor although there is much greater diversity in the I-65 case. A complete list of the materials indicated by the responding fixed facilities is contained in Figure 4-5.

COMPOSITION OF HAZARDOUS MATERIALS, SHIPMENTS (TO AND FROM) FIXED FACILITIES IN THE I-65 CORRIDOR

Top Five Hazardous Materials



Hazardous Material found in the ***"Other"*** Category:

1001	1193	1778	1977	2834
1005	1198	1790	2031	2923
1013	1210	1791	2032	2997
1046	1212	1805	2072	3018
1049	1219	1820	2187	3065
1058	1230	1823	2214	3082
1062	1263	1830	2315	3265
1066	1294	1831	2553	9188
1072	1301	1832	2581	
1075	1307	1866	2582	
1079	1456	1910	2672	
1090	1490	1942	2761	
1114	1500	1951	2790	
1170	1710	1963	2809	
1173	1760	1966	2831	

Figure 4-5

CHAPTER FIVE
SUMMARY AND SYNTHESIS

Hazardous materials are an important part of the contemporary American economy. Hazardous materials are produced, transported, stored, used, and discarded. Incidents involving the release of hazardous materials to the environment can take place during any of these activities. To date, communities have generated more thoughtful and quantifiable information about the production and storage of hazardous materials than they have about their transportation. We hear more "not ***in*** my back yard" comments than we hear "not ***through*** my back yard" comments. This comes as little surprise.

This is an important inadequacy in our base of knowledge because all communities, large and small, experience the transportation of hazardous materials through their jurisdictions regardless of whether those materials are produced, stored, or used there. The United States Environmental Protection Agency estimates that at least 25 percent of all incidents involving the release of hazardous materials (other than fuels) occur during the transportation of these materials despite the finest transportation infrastructure in the world. The United States Department of transportation reports that truck transportation of hazardous materials accounted for 93.6 billion ton miles of traffic between 1982 and 1993 within the United States. During that time, 6,175 incidents involved the release of hazardous materials and resulted in 249 injuries and 11 deaths per year.

Hence, it behooves all communities to initiate construction of a knowledge base that concerns the types of hazardous materials, in addition to their relative frequency, timing, and routing, being transported into, out of, and through their jurisdictions. The emergency response planning process must be predicated on an adequate portrayal of these elements of hazmat movements. The adequacy of emergency response organizational schemes, equipment inventories and purchases, and personnel training can only be assessed in light of this type of information.

The current report is an initial attempt to develop the necessary knowledge base to make informed decisions about the appropriateness of existing emergency response systems located along the I-65 corridor in Kentucky. This corridor is composed of the 137 mile interstate segment and the nine (9) counties it intersects, stretching from Louisville in the north to Franklin, Kentucky in the south. It is hoped that the information contained in this report is helpful in starting (or continuing) to assess the risk of transportation incidents involving the release of hazardous materials within the I-65 corridor. That is the intent.

This study provides focus on highway transportation only. The empirical results that are summarized below are based on the following:

> (a.) A five year hazmat incident history, 1991-1995, within the I-65 corridor based on collation of data from the USDOT Hazardous Material Incident System (HMIS), the Kentucky Department of Environmental Protection, the Kentucky Fire Marshal, and

municipal sewer data from Jefferson County;
(b.) A three month placard survey of 600 observational hours accomplished at 4 sets of observational locations along the corridor;
(c.) A fixed facility survey of 261 establishments storing 500 pounds or exceeding threshold planning quantities of extremely hazardous materials (EHSs).

Perhaps the most significant results are summarized in the statements that follow. Each result judged significant is accompanied by a recommendation for enhancing the emergency planning process. The recommendations provided are those of the author and are intended as points of departure for more thoughtful discussion by professionals and other experts. If they stimulate debate among members of the emergency response community within the I-65 corridor, then they meet with success.

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RESULT 1. The five year history indicates an average of 111 incidents per year within the I-65 corridor. There is, however, substantial variation between years and this is loosely correlated with the general U.S. business cycle.

RECOMMENDATION 1. The emergency response community should closely monitor indexes of general economic activity as a useful predictor of truck movements in general and hazmat incidents in particular. The first year of recovery after a sustained economic lull appears to be a particularly dangerous period in this corridor.

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RESULT 2. The five year history indicates that the spatial distribution of hazmat incidents occurs roughly in proportion to the density of population and economic activity found within the jurisdiction. It is only loosely tied to estimates of hazmat vehicle miles taking place within the jurisdiction.

RECOMMENDATION 2. Emergency response planners should maintain a systematic inventory of economic and demographic change within the corridor as a means of anticipating where emergency response capacity will need updating, dependent on growth (and decline) patterns. For example, the Bowling Green area has enjoyed considerable economic development during the past two years. The area attracted 2,375 industrial jobs between 1991 and 1995.

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RESULT 3. Major hazmat incidents are less concentrated in Jefferson County (48 percent of the corridor's total) than are total hazmat incidents (73 percent of the corridor's total). A large portion of low velocity, low impact incidents occur in the metropolitan settings. Since major incidents are more uniformly distributed within the corridor, this feature accentuates the need for smaller sized (rural) jurisdictions to provide effective response services at a level of sophistication similar to that of large urban places.

RECOMMENDATION 3. A multi-jurisdictional approach to emergency response (within the constraint of acceptable response time) reduces the need for redundancy of equipment, services,

personnel, and training. In this fashion, needed sophistication can be attained with an eye toward cost effectiveness (efficiency).

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RESULT 4. The five year history indicates the high frequency of released motor fuels and fluids in transportation (hazmat) incidents. Over half of all required responses (using USDOT's EMERGENCY RESPONSE GUIDEBOOK) involve Guide Number 128 as a direct result.

RECOMMENDATION 4. Response Guide Number 128 should receive special attention in the training of all levels of emergency response personnel and citizens living in the corridor. This response category is invoked over 55 times per year within the corridor. This training focus should be added to a continuing broad-based and inclusive program of public awareness and response training.

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RESULT 5. Jefferson County has experienced a disproportionately large variety of hazardous materials released during the five year period that was chronicled. Incidents within Jefferson County on I-65 are more likely outside the I-264 loop.

RECOMMENDATION 5. Jefferson County emergency response planners should encourage the design of a very systematic approach to personnel training that emphasizes the need for very broad-based response expertise. Perhaps peer leadership with some level of specialization at the individual level could be employed to meet the collective need for breadth. Planners should maintain vigilance for strategic location of response units for the most effective response times possible.

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RESULT 6. Truck and hazmat frequencies are higher in the southern regions of the I-65 corridor. Truck traffic is 26 percent higher outside the Louisville region while hazmat densities are 77 percent higher. These differences suggest clearly that drivers make every effort to avoid the central Louisville region on I-65.

RECOMMENDATION 6. Emergency response capacity should, at least in part, reflect the significant differences in community risk that is indexed by higher hazmat densities in the southern regions of the corridor.

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RESULT 7. Hazmat flows peak on Wednesdays in the I-65 corridor (8.0 hazmats/hour) and there is a strong Sunday hazmat lull (2.4 hazmats/hour). The Louisville region provides a modest peak (6.9 hazmats/hour) on Tuesdays while they peak on Wednesdays (8.1 hazmats/hour) to the south. Louisville has a larger density on Fridays than does the south. However, weekend hazmat flows are disproportionately high in the south.

RECOMMENDATION 7. Emergency response planning should clearly recognize and accomodate peaks and lulls in hazmat movements since the probabilty of incidentsvary in

proportion to these basic hazmat densities.

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RESULT 8. Peak hazmat flows are maximized during the midday period and are nearly twice as great as the late night lull within the corridor. However, the morning (7-10 a.m.) receives the second highest frequency across the corridor which adds to already congested commuter traffic, especially in urban settings. The midday hazmat peak is less dramatic in the Louisville region.

RECOMMENDATION 8. The temporal redistribution of hazmat shipments out of early morning commuter traffic would be of benefit to all concerned. Planners should develop awareness of this less painful step in easing the mix of hazmat traffic with other users.

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RESULT 9. The southern portion of the corridor has higher densities of hazmats and it also witnesses a much wider variety of hazardous materials engaged in transportation. The level of variety appears to be about 80 percent higher in the southern region.

RECOMMENDATION 9. Emergency response training and equipment inventories must recognize the diversity of materials that pose potential risk. This variety, during transportation, is present in rural and urban settings.

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RESULT 10. Although there are strong regional commonalities in the composition of hazmat flows within the I-65 corridor, there are also some regionally distinctive elements. There are significantly more hot liquids, liquid oxygen, and LPG flowing through Louisville. There are more liquid hazardous wastes, paints, inks, and acids in the south.

RECOMMENDATION 10. Emergency response training and equipment inventories should be rationalized (prioritized) on the basis of known differences in hazmat composition. For example, response guides 128, 127, 153, 111, and 154 are required in nearly equal proportions throughout the corridor. However, training curriculum might provide greater emphasis on guides 122 and 121 in Louisville and 171 and 129 in the southern portion of the corridor based on the composition of materials being transported through.

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RESULT 11. According to the fixed facility survey in the I-65 corridor, the average facility increased its shipments (in and out) of hazardous materials by about 50 percent between 1991 and 1995. Much of this increase is associated with significant growth of a single very large facility. However, even smaller facilities averaged an increase of hazmat flow volumes by over 15 percent.

RECOMMENDATION 11. All data indicate a general increase of hazmat movements on I-65 (including through traffic) and on local routes that access I-65. Local jurisdictions need to remain prepared for incidents on and off the interstate system. Coordination for coverage of the I-65 segments is essential and probably requires a multi-jurisdictional approach to be efficient

and effective.

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RESULT 12. The fixed facility survey indicates that a substantial portion of hazmat flows generated by the facilities in the I-65 corridor are intra-corridor (33 percent) and intrastate (49 percent). This is somewhat less localized, however, than was the case for the I-75 corridor.

RECOMMENDATION 12. The localized nature of many hazmat movements suggests the possibility for efforts to coordinate hazmat flows to avoid difficult shipping times, e.g., the morning peak. This would be more difficult to execute in the I-65 corridor than in the I-75 corridor where movements are even more localized.

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RESULT 13. The fixed facility survey points to higher frequency hazmat movements for certain materials that are locally important and not revealed in the five year incident history or the placard survey.

RECOMMENDATION 13. Emergency response planners must recognize high frequency (low volume) movements of chlorine (1017), caustic soda (1824), and hydrochloric acid (1789).

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The preceding pairs of results/recommendations are provided as a way of summarizing some of the more significant findings of the research and extending that information into the realm of policy. The more detailed results contained in the body of this report will be of interest to locales within the I-65 corridor. Please not that this report is no more than a glimpse of hazardous materials movements and its results are qualified by time (1991-95) and by place (the I-65 corridor). The transferability of these results to other times or places is questionable. Indeed, one of the points that emerges from the three corridor studies completed to date is that corridors are different. They may share a few similarities, but variation is more common. Under the leadership of the Kentucky Emergency Response Commission, I-64 (completed during summer of 1995) and I-75 (completed during fall of 1995) corridor studies are in hand. With completion of the I-65 study, these individual glimpses are rapidly evolving into a panoramic view of major hazmat movement patterns across the Commonwealth. In the spirit of this type of integrative and synthetic need, the final Chapter provides an initial comparison of the three corridors studied to date, I-64, I-65, and I-75. Summary of the corridors' similarities and magnification of corridor differences help to provide additional focus for emergency response preparedness in different parts of the Commonwealth.

CHAPTER SIX
COMPARISON OF THE COMMODITY FLOW ANALYSES ON I-64, I-65, AND I-75

This Chapter provides a very short statement in way of effective summary of the primary similarities and differences that characterize hazmat movements in the I-64, I-65, and I-75 interstate corridors within Kentucky. These statements help to place each corridor into larger context and this should yield additional insight concerning the appropriate focus for emergency response training, equipment, and the location of emergency response services. Of the many configurations that a state-wide response system can take, at least a few should make more sense than others after digestion of this food for thought. The recent record (1991-1995) of hazmat incidents, statewide, is provided in Figure 6-1. This visualization of the data gives immediate importance to the corridors that have undergone scrutiny thus far, I-64, I-65, and I-75. In sum the three corridors account for about 93 percent of the hazmat incidents reported statewide between 1991 and 1995. The interstate system within Kentucky in general, is fully aligned with the high density of dots symbolizing these recent hazmat incidents. The two most urbanized counties in the Commonwealth, Fayette and Jefferson, account for 57 percent of the Kentucky's total hazmat incidents over the past five years.

The basic differences (and similarities) between the three corridors are highlighted in Table 6-1. Only those differences (or similarities) that are thought to be statistically significant or substantively interesting are included in this initial comparison. More rigorous comparison is needed after all corridor studies are complete. Please be reminded that only the I-64 study permits assessment of seasonal variation in hazmat flows because its placard survey was conducted over a full 12 months. The I-75 and current I-65 survey were accomplished in two months each and do not permit seasonal analyses.

The I-64 corridor in Kentucky involves 12 counties and 191 miles of interstate. The I-75 corridor in Kentucky involves 9 counties and 195 miles of interstate. The I-65 corridor in Kentucky also involves 9 counties and is a bit shorter at 137 miles. Fayette County (Lexington) is included in both I-64 and I-75 corridors. Jefferson County (Louisville) is included in both I-64 and I-65 corridors. By virtue of Jefferson County's inclusion in the I-64 and I-65 corridors, they are substantially more populated than the I-75 corridor. Since Jefferson is also the premiere manufacturing county in the Commonwealth, I-64 and I-65 have more manufacturing plants and Tier II monitored facilities than does I-75. There are significantly more trucks per hour rolling up and down I-65. In fact, there are nearly 83 percent more trucks on I-65 than there are on I-64. However, the density of hazmats per hour is substantially higher on I-64, 18 percent more than on I-65 and 34 percent more than on I-75. This high density pays testimony to the functional role that I-64 plays in fusing together a group of cities noteworthy for their heavy industry, including fuels, chemicals, and metals manufacture.

I-65 seems to be less regionalized than the other two corridors. In the cases of I-64 and I-75, .

HAZARDOUS MATERIAL TRANSPORTATION INCIDENTS IN KENTUCKY

(1991-1995)

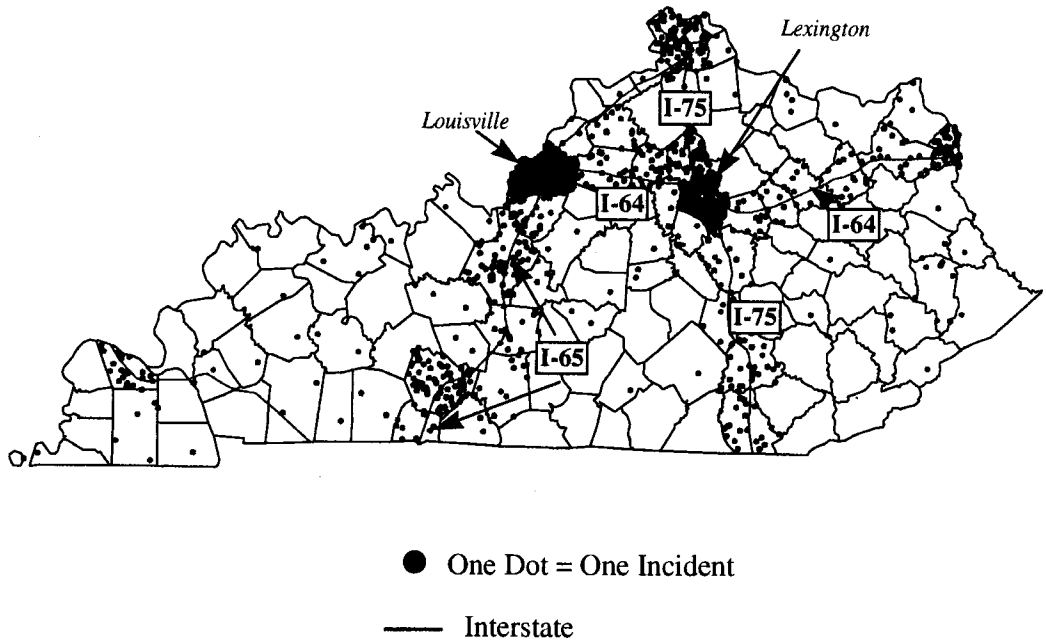

Figure 6-1

TABLE 6-1
Comparison of the
I-64, I-65, and I-75 Corridors

Variable Category	Corridor: I-64	I-75	I-65
General:			
Population	1,189,135	654,251	995,298
Manufacturing Plants	1,514	727	1,277
EHS Fixed Facilities	298	58	261
Traffic:			
Trucks/hr.	116	158	212
Hazmats/hr.	6.64	4.97	5.61
Peak Hazmat Day	Wednesday	Wednesday	Wednesday
Peak Hazmat Hours	7-10 am	10 am-4 pm	10am-4 pm
Maximum Hazmat Direction	Eastbound	Southbound	Northbound
Maximum Hazmat Region	West	South	South
Hazmat Composition:			
Number of Different Materials	252	250	233
Placard 1203 (Percent of Hazmats)	22	10	21
Maximum Response Guide Number	27 (33%)	26 (28%)	27 (33%)
Hazmat Incidents, 5 recent years			
Total Number of Hazmat Incidents	1,024	495	554
Average Per Year	205	99	111
Percent in Top County	48 (Jeff.)	60 (Fay.)	73 (Jeff.)
Number of "Major" Incidents	160	62	75
Number of Materials Released	128	88	80
Placard 1993 (% of incidents)	37	38	54
Placard 1203 (% of incidents)	8	4	8
Placard 1760 (% of incidents)	8	13	7

there are dramatic differences in the frequencies and compositions of hazmats between regions of the corridors. In the case of I-64, traffic (general truck and hazmat) is much higher on the west side but the variety of materials encountered is much greater in the east. Within I-75, the south experiences much higher frequencies of both general truck and hazmat movements. The southern region also experiences a substantially wider variety of hazardous materials within the I-75 corridor. I-65's regional differences are less pronounced than the other corridors' are. The southern portion does have modestly higher truck traffic. Hazmat frequencies are a bit more differentiated between Louisville and the south on I-65. I-65 and I-64 are much less fuels oriented than is I-75. I-64 is much more prone to hazmat incidents than are I-75 or I-65. In fact, the number of hazmat incidents in the I-64 corridor is roughly equivalent to the combined total for the number of hazmat incidents in the I-65 and I-75 corridors. Additionally, a much larger variety of materials has been released in the I-64 corridor over the past five years. A much larger portion of these have been classified in this report as major incidents (in term of volume released).

The three corridors that have been examined to date are quite different in a number of ways. East/ west oriented I-64 is qualitatively different from the two north/south oriented corridors. As these corridors (and those that remain to be studied) are more closely scrutinized with the data now in hand, other important points will be made and issues raised.

APPENDIX A
FIXED FACILITY QUESTIONNAIRE

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MILITARY AFFAIRS
OFFICE OF THE ADJUTANT GENERAL
BOONE NATIONAL GUARD CENTER
FRANKFORT, KENTUCKY 40601-6168

REQUEST TO ALL FIXED FACILITIES DEALING WITH HAZARDOUS MATERIALS

Effective planning is the key to efficient and effective responses to incidents involving the transportation of hazardous materials. Your facility either receives or sends hazardous materials as a part of normal operations. The United States Department of Transportation has authorized local emergency planning committees to conduct studies that reveal patterns in the transportation of hazardous materials involving both local and interstate shipments. The purpose of these studies is to indicate where and when hazardous materials are moving across the interstate highways and connectors to the interstate system.

Currently, researchers at Morehead State University, in concert with the Kentucky Emergency Response Commission and Local Emergency Planning Committees, are monitoring truck movements along I-65. Your facility is located within the I-65 corridor. You are asked to indicate basic information about the manner in which you send/receive hazardous materials. This will help us determine whether patterns exist in the places and timing of hazardous materials shipments. Your cooperation is needed if the study is to be successful. The information that you provide will be included in summary statistics only.

Please complete the enclosed questionnaire as accurately as possible. If you have any questions concerning the authority to require compliance or if you need clarification of any parts of the questionnaire, do not hesitate to call Ron Mitchelson (606-783-2655) or Patrick Conley (502-564-5221). Please use the envelope provided and return no later than one week after receipt (or) July 10, 1996.

Your assistance is appreciated.

Sincerely,

John R. Groves, Jr.
Brigadier General, KyNG
The Adjutant General

JRG/LO:lo
Enclosure

KENTUCKY EMERGENCY RESPONSE COMMISSION
AND MOREHEAD STATE UNIVERSITY

HAZARDOUS MATERIALS TRANSPORTATION STUDY
I-65 CORRIDOR IN KENTUCKY

FIXED FACILITY QUESTIONNAIRE
NUMBER: _____

A: FACILITY INFORMATION

Please provide information about the facility's owner, location, and a contact person should other information be needed.

1. Company Name and Mailing Address
   Name: _____
   Street/PO: _____
   City: _____ State: _____
   ZIP: _____

2. Facility Location
   County: _____
   Nearest City: _____
   Street: _____
   Nearest Intersection: Route _____ and Route _____

3. Contact Person
   Name: _____
   Title: _____
   Telephone: _____

B: RECENT TRENDS

4. Please indicate the total tonnage of hazardous materials shipped and received by the facility during the calendar years indicated (January 1 through December 31).

1991 _____ tons 1992 _____ tons 1993 _____ tons 1994 _____ tons 1995 _____ tons

C: HAZARDOUS MATERIAL TRANSPORTATION PATTERNS

5. Which mode is most frequently used in shipping and receiving hazardous

Truck ____ Rail ____ Barge ____ Other (Specify _____)

6. Are climatic conditions considered by the facility when scheduling the shipment or receipt of hazardous materials? YES ____ NO ____

FOR HAZARDOUS MATERIAL SHIPMENTS FROM THE FACILITY

7. Day(s) for routine shipments: None ____ Monday ____ Tuesday ____ Wednesday ____ Thursday ____ Friday ____ Saturday ____ Sunday ____

8. Hours of day when hazardous material shipments normally leave the facility: No Routine ____ 6am-9am ____ 12pm-4pm ____ 6pm-12am ____
   12am-6am ____ 9am-12pm ____ 4pm-6pm ____

FOR HAZARDOUS MATERIALS RECEIVED BY THE FACILITY

9. Day(s) for routine shipments: None ____ Monday ____ Tuesday ____ Wednesday ____ Thursday ____ Friday ____ Saturday ____ Sunday ____

10. Hours of day when facility normally receives hazardous materials: No Routine ____ 6am-9am ____ 12pm-4pm ____ 6pm-12am ____
    12am-6am ____ 9am-12pm ____ 4pm-6pm ____

11. Are hazardous materials ever shipped or received on legal holidays? YES ____ NO ____

D: DETAIILED INFORMATION FROM JANUARY 1, 1995 TO DECEMBER 31, 1995

12. Total number of trucks (placarded) with hazardous materials received? _____ trucks

13. Total number of trucks (placarded) with hazardous materials shipped? _____ trucks

14. Total tonnage ofplacarded hazardous materials shipped and received by truck? _____ tons

E: ROUTES TAKEN FOR PERIOD FROM JANUARY 1, 1995 TO DECEMBER 31, 1995

15. If trucks coming to or leaving your facility were to proceed to (or come from) I-65, how would they normally get to that interstate (I-65)?

A. Route normally taken if north bound (use route numbers).

B. Route normally taken if south bound (use route numbers).

Please provide information for EACH of the five most frequently shipped or received (BY TRUCK) hazardous materials.

F: FIVE MOST FREQUENTLY TRANSPORTED HAZARDOUS MATERIALS FROM JANUARY 1, 1995 TO DECEMBER 31, 1995. *TRUCK MOVEMENTS ONLY PLEASE!*

MATERIAL NUMBER ONE:

16. Chemical Name: _____ 17. Four digit placard number _____

18. Shipped ? (√) _____ Or Received ? (√) _____

19. Please indicate most frequent origins (for received) or destinations (for shipment). A. _____ CITY _____ STATE

B. _____ CITY _____ STATE C. _____ CITY _____ STATE D. _____ CITY _____ STATE

20. Typically transported most often during which season? (√ any that apply) Variable (on demand) ____ April-June ____ September-December ____ January-March ____ June-August ____

MATERIAL NUMBER TWO:

21. Chemical Name: _____ 22. Four digit placard number _____

23. Shipped ? (√) _____ Or Received ? (√) _____

24. Please indicate most frequent origins (for received) or destinations (for shipment). A. _____ CITY _____ STATE

25. Typically transported most often during which season? (√ any that apply) Variable (on demand) ____ April-June ____ September-December ____
January-March ____ June-August ____

MATERIAL NUMBER THREE:

26. Chemical Name: _____ 27. Four digit placard number _____

28. Shipped ? (√) _____ Or Received ? (√) _____

29. Please indicate most frequent origins (for received) or destinations (for shipment). A. _____ (CITY) _____ (STATE)

B. _____ (CITY) _____ (STATE) C. _____ (CITY) _____ (STATE) D. _____ (CITY) _____ (STATE)

30. Typically transported most often during which season? (√ any that apply) Variable (on demand) ____ April-June ____ September-December ____
January-March ____ June-August ____

MATERIAL NUMBER FOUR:

31. Chemical Name: _____ 32. Four digit placard number _____

33. Shipped ? (√) _____ Or Received ? (√) _____

34. Please indicate most frequent origins (for received) or destinations (for shipment). A. _____ (CITY) _____ (STATE)

B. _____ (CITY) _____ (STATE) C. _____ (CITY) _____ (STATE) D. _____ (CITY) _____ (STATE)

35. Typically transported most often during which season? (√ any that apply) Variable (on demand) ____ April-June ____ September-December ____
January-March ____ June-August ____

MATERIAL NUMBER FIVE:

36. Chemical Name: _____ 37. Four digit placard number _____

38. Shipped ? (√) _____ Or Received ? (√) _____

39. Please indicate most frequent origins (for received) or destinations (for shipment). A. _____ (CITY) _____ (STATE)

B. _____ (CITY) _____ (STATE) C. _____ (CITY) _____ (STATE) D. _____ (CITY) _____ (STATE)

40. Typically transported most often during which season? (√ any that apply) Variable (on demand) ____ April-June ____ September-December ____
January-March ____ June-August ____

APPENDIX B
EXAMPLE PAGES FROM DATA SETS:

- Transportation Incidents Five Year History, 1991 to 1995
- Hourly Data Set Placard Survey
- Individual Hazmat Records Placard Survey
- Fixed Facility Survey

**Please note that only example pages of each data set are provided in the appendix. Complete duplication in paper format of all data would exceed 139 pages. Machine readable versions are available from the primary authors upon request to and approval from the Kentucky Emergency Response Commission.

County	Material	Quantity	Date	Number	Response
Jefferson	Gasoline	5000	Jan-90	1203	27
Jefferson	Sludge	300	Jan-90	3077	31
Jefferson	Kerosene	1000	Jan-90	1223	27
Jefferson	Cleaning Liquid	7.5	Jan-90	1760	60
Warren	Cement	1	Jan-90	1133	26
Jefferson	Corrosive Liquid	0.5	Feb-90	1760	60
Jefferson	Gasoline	10	Mar-90	1203	27
Warren	Amm. Hydroxide	1	Mar-90	2672	60
Hart	Gasoline	530.5	Mar-90	1203	27
Jefferson	Waste	60	Mar-90	3082	31
Hart	Fuel Oil	530.5	Mar-90	1993	27
Jefferson	Methyl Amyl Ketone	1	Mar-90	1110	26
Barren	Fungicide	55	Apr-90	1759	60
Jefferson	Calcium Carbide	55	Apr-90	1402	40
Jefferson	Gasoline	4	Apr-90	1203	27
Jefferson	Gasoline	20	Apr-90	1203	27
Jefferson	Resin Solution	1	May-90	1866	26
Jefferson	Corrosive Liquid	3	May-90	1760	60
Bullitt	Orm-B N.O.S.	25	May-90	1760	60
Jefferson	Sodium Hydroxide	0.25	May-90	1824	60
Jefferson	Mineral Spirits	45	Jun-90	3065	26
Jefferson	Corrosive Liquid	0.03	Jul-90	2922	59
Jefferson	Paint	12.38	Jul-90	1263	26
Jefferson	Adhesive	1	Jul-90	1133	26
Jefferson	Corrosive Liquid	5	Aug-90	1760	60
Jefferson	Resin Solution	0.03	Sep-90	1866	26
Warren	Cleaning Liquid	1	Sep-90	1760	60
Jefferson	Resin Solution	4	Oct-90	1866	26
Jefferson	Xylene	7	Oct-90	1307	27
Jefferson	Corrosive Liquid	5	Oct-90	1760	60
Jefferson	Monomer	55	Nov-90	1993	27
Jefferson	Denatured Alcohol	15	Nov-90	1987	26
Jefferson	Isopropanol	15	Dec-90	1219	26
Jefferson	Hydrochloric Acid	0.06	Dec-90	1789	60
Jefferson	Petroleum Gas	500	Jan-91	1075	22
Jefferson	Hydrochloric Acid	0	Jan-91	1789	60
Jefferson	Petroleum Oil	3	Jan-91	1270	27
Jefferson	Corrosive Liquid	0.05	Feb-91	1760	60
Jefferson	Flamm Liquid	0.5	Feb-91	1993	27
Jefferson	Combustible Liquid	0.13	Mar-91	1993	27
Jefferson	Gasoline	25	Apr-91	1203	27
Jefferson	Caustic Alkali	28	May-91	1719	60
Jefferson	Paint	1	May-91	1263	26
Jefferson	Paint	0.06	May-91	1263	26
Jefferson	Resin Solution	1	May-91	1866	26
Jefferson	Corrosive Liquid	5	Jun-91	1760	60
Jefferson	Amm Solutions	0.5	Jun-91	2683	28
Jefferson	Sodium Hydroxide	2	Jun-91	1824	60
Jefferson	Methanol	1	Jul-91	1230	28
Jefferson	Corrosive Liquid	0.13	Jul-91	2920	29
Jefferson	Cleaning Liquid	1	Jul-91	1760	60
Jefferson	Corrosive Liquid	0.25	Jul-91	1760	60
Jefferson	Compressed Gas	0.02	Jul-91	1953	18
Jefferson	Ink	50	Aug-91	1210	26
Jefferson	Flamm Liquid	0.13	Sep-91	1993	27
Jefferson	Cleaning Liquid	0.13	Sep-91	1760	60
Jefferson	Methanol	1	Sep-91	1230	28
Jefferson	Resin Solution	1	Sep-91	1866	26
Jefferson	Fire Extinguishers	2.5	Sep-91	1044	12
Jefferson	Acetone	1	Sep-91	1090	26
Jefferson	Methanol	0.13	Oct-91	1230	28
Jefferson	Methanol	1.5	Oct-91	1230	28
Hardin	Ink	25	Nov-91	1210	26
Jefferson	Corrosive Liquid	0.01	Dec-91	1760	60
Jefferson	Gasoline	50	Dec-91	1203	27
Jefferson	Corrosive Liquid	1	Dec-91	1760	60

Hourly Data Set

Date	Hour	Place	Type	Trucks	Hazmats	Day
40696	700	1	ex	141	3	sat
40696	700	2	ex	136	2	sat
40696	800	2	ex	144	2	sat
40696	800	1	ex	132	2	sat
40696	900	2	ex	151	3	sat
40696	900	1	ex	138	4	sat
40696	1000	1	ex	157	2	sat
40696	1000	2	ex	138	1	sat
40696	1100	1	ex	141	5	sat
40696	1100	2	ex	124	3	sat
40696	1300	1	ex	128	1	sat
40696	1300	2	ex	102	2	sat
40696	1400	1	ex	132	2	sat
40696	1400	2	ex	126	1	sat
40696	1500	1	ex	103	1	sat
40696	1500	2	ex	91	2	sat
40696	1600	1	ex	78	3	sat
40696	1600	2	ex	75	2	sat
40696	1700	2	ex	71	0	sat
40696	1700	1	ex	73	1	sat
40696	1800	1	ex	98	2	sat
40696	1800	2	ex	83	1	sat
40696	1900	1	ex	102	3	sat
40696	1900	2	ex	81	0	sat
40796	700	4	ex	67	1	sun
40796	700	3	ex	56	2	sun
40796	800	4	ex	73	1	sun
40796	800	3	ex	62	2	sun
40796	900	3	ex	58	0	sun
40796	900	4	ex	56	1	sun
40796	1000	3	ex	57	4	sun
40796	1000	4	ex	69	2	sun
40796	1100	3	ex	60	4	sun
40796	1100	4	ex	45	1	sun
40796	1200	3	ex	72	2	sun
40796	1200	4	ex	75	4	sun
40796	1300	4	ex	67	0	sun
40796	1300	3	ex	72	2	sun
40796	1400	3	ex	84	1	sun
40796	1400	4	ex	82	2	sun
40796	1500	3	ex	74	1	sun
40796	1500	4	ex	83	3	sun
40796	1800	2	ex	84	2	sun
40796	1800	1	ex	76	2	sun
40796	2000	2	ex	106	0	sun
40796	2000	1	ex	86	1	sun
40896	700	2	ex	172	4	mon
40896	700	1	ex	163	5	mon
40896	800	2	ex	176	1	mon
40896	800	1	ex	169	3	mon
40896	900	1	ex	203	3	mon
40896	900	2	ex	231	3	mon
40896	1000	1	ex	297	10	mon
40896	1000	2	ex	286	4	mon
40896	1100	2	ex	251	7	mon
40896	1100	1	ex	279	6	mon
40896	1300	1	ex	236	4	mon
40896	1300	2	ex	229	8	mon
40896	1400	1	ex	291	5	mon
40896	1400	2	ex	182	11	mon
40896	1500	2	ex	262	5	mon
40896	1500	1	ex	277	11	mon
40896	1600	1	ex	166	5	mon
40896	1600	2	ex	193	7	mon
40896	1700	1	ex	203	7	mon
40896	1700	2	ex	213	3	mon

Date	Hour	Place	Type	Dot #	Carrier	Response
40696	700		1 ex	1203	Statewide	27
40696	700		1 ex	1203	Swifty	27
40696	700		1 ex	9	Unknown	11
40696	700		2 ex	10	Unknown	47
40696	700		2 ex	1203	Thornton's	27
40696	800		2 ex	2	Unknown	59
40696	800		2 ex	1203	Swifty	27
40696	800		1 ex	1203	Halzit	27
40696	800		1 ex	3	Schneider	26
40696	900		2 ex	1075	Unknown	22
40696	900		2 ex	1203	Thornton's	27
40696	900		2 ex	3	Schneider	26
40696	900		1 ex	1203	Thornton's	27
40696	900		1 ex	2	CF	59
40696	900		1 ex	1993	Unknown	27
40696	900		1 ex	1203	Thornton's	27
40696	1000		1 ex	3	Land Air	26
40696	1000		1 ex	1203	Johnson Oil	27
40696	1000		2 ex	3	Overnite	26
40696	1100		1 ex	9	Unknown	11
40696	1100		1 ex	9	Unknown	11
40696	1100		1 ex	2	Unknown	59
40696	1100		1 ex	1866	Highway Transport	26
40696	1100		1 ex	2	Watkins	59
40696	1100		2 ex	3	Yellow	26
40696	1100		2 ex	1203	Petro. Express	27
40696	1100		2 ex	1203	Lexington Transp.	27
40696	1300		1 ex	1203	Thornton's	27
40696	1300		2 ex	1203	Thornton's	27
40696	1300		2 ex	3057	Hoyer	16
40696	1400		1 ex	9	Yellow	11
40696	1400		1 ex	1866	Highway Transport	26
40696	1400		2 ex	1170	Oakley	26
40696	1500		1 ex	4	Service Transport	16
40696	1500		2 ex	2	Overnite	59
40696	1500		2 ex	1203	Petro. Express	27
40696	1600		1 ex	2922	Slutties	59
40696	1600		1 ex	1203	Thornton's	27
40696	1600		1 ex	1750	Heil	59
40696	1600		2 ex	2	Davis	59
40696	1600		2 ex	2	Overnite	59
40696	1700		1 ex	1203	Swifty	27
40696	1800		1 ex	3	Schneider	26
40696	1800		1 ex	4	Overnite	16
40696	1800		2 ex	2	Unknown	59
40696	1900		1 ex	1203	Thornton's	27
40696	1900		1 ex	22	Unknown	26
40696	1900		1 ex	9	Overnite	11
40796	700		4 ex	1203	Swifty	27
40796	700		3 ex	9	Overnite	11
40796	700		3 ex	3	Schneider	26
40796	800		4 ex	1203	Swifty	27
40796	800		3 ex	3	Unknown	26
40796	800		3 ex	1203	Thornton's	27
40796	900		4 ex	1203	Thornton's	27
40796	1000		3 ex	1203	Swifty	27
40796	1000		3 ex	2584	Usher	60
40796	1000		3 ex	1203	Super America	27
40796	1000		3 ex	9	Roadway	11
40796	1000		4 ex	9	CF	11
40796	1000		4 ex	15	CF	55
40796	1100		3 ex	1203	Thornton's	27
40796	1100		3 ex	1966	Air Products	22
40796	1100		3 ex	1203	Halzit	27
40796	1100		3 ex	2	Nationwide Carrier	59
40796	1100		4 ex	1203	Swifty	27

Fixed Facility Survey

No.	Company	County	City	1991	1992	1993	1994	1995	Mode	Outday	Otime	Inday
1	Merchants Ice Co	Jefferson	Louisville	9.5	2	5.5	4.5	9	Truck	None	None	M-F
2	Rhone Poulenc Inc.	Jefferson	Louisville									
3	Hardin Co. Milling Co.	Hardin	Elizabethtown	1	1	1	1	1	Truck	None	None	None
4	Whispering Oaks	Jefferson	Louisville									
5	Winn Dixie	Jefferson	Louisville	1	1	1	1	1	Truck	None	None	M-F
6	United Catalysts	Jefferson	Louisville	11,353	11,164	13,326	16,182	22,341	Truck	None	None	None
7	Vine Grove Wastewater Pl	Hardin	Radcliff	2.4	2.4	2.4	2.4	2.4	Truck	None	None	None
8	BOC Gases	Jefferson	Louisville	n/a	n/a	1,600	1,600	1,600	Truck	None	None	None
9	E-Town WWTP	Hardin	Elizabethtown	10	10	16.5	22	24	Truck	None	None	None
10	United Catalysts	Jefferson	Louisville	3,070	3,510	3,764	3,082	5,442	Truck	None	None	None
11	Air Products	Jefferson	Louisville	n/a	n/a	n/a	n/a	n/a	Truck	M-F	6a-9a, 4p-6p	M-F
12	City Springs Water Plant	Hardin	Elizabethtown	12	13	14	15	15	Truck	None	None	M-F
13	Freeman Lake Water Plant	Hardin	Elizabethtown	8	9	10	12	13	Truck	None	None	M-F
14	Uofl. Hospital	Jefferson	Louisville	1	1	1	1	1	Truck	None	12p-4p, 9a-12p	None
15	Farmers Supply	LaRue	Hodgenville									
16	Felker Bros. Corp	Barren	Glasgow	n/a	n/a	15	374	287	Truck	F	6a-9a	Tue,F
17	City of Brownsville	Edmonson	Brownsville									
18	Ideal Hardware Co.	Barren	Bowling Green	2	2	2	2	2	Truck	None	None	M-F
19	Ulrich Chemical	Jefferson	Louisville	2,200	2,300	2,500	2,300	2,600	Truck	M-F	6a-9a	M-F
20	Sealed Power	Simpson	Franklin	n/a	n/a	n/a	n/a	233	Truck	M-F	9a-12p	M-F
21	Brandenburg Telephone	Hardin	Radcliff									
22	Glasgow Spray-Dry Inc.	Barren	Glasgow									
23	Englehard Corp.	Jefferson	Louisville	5,808	4,795	6,263	6,862	5,667	Truck	M-F	6a-9a, 12p-4p	M-F
24	Citgo Petro. Corp.	Jefferson	Louisville	n/a	n/a	n/a	n/a	15	Truck	None	None	None
25	Cardinal Aluminum Co.	Jefferson	Louisville	n/a	n/a	n/a	n/a	1,525	Truck	None	None	M-F
26	Cardinal Aluminum Co.	Jefferson	Louisville	n/a	n/a	n/a	n/a	316	Truck	None	None	M-F
27	Sturgeon Pest Control	Jefferson	Louisville									
28	Green River Valley Water	Barren	Cave City	100	55	55	0	110	Truck	None	None	None
29	SKF USA, Inc.	Barren	Glasgow	19	29	22	23	33	Truck	None	9a-12p	None
30	Bioproducts Inc.	Jefferson	Louisville	30,090	31,011	31,980	32,732	35,380	Rail	None	None	None
31	American Printing House	Jefferson	Louisville	2,417	3,158	2,593	1,865	809	Truck	M-F	None	None
32	Edmonson Co. Water Dis.	Grayson	Leitchfield	0	2.1	2.9	3.1	4.1	Truck	None	None	None
33	Edmonson Co. Water Dis.	Edmonson	Brownsville	5.5	5.8	6.3	6.3	6.8	Truck	None	None	None
34	Hardin Co. Water Dis. #2	Hardin	Elizabethtown	10.7	14.7	17	18.5	23.3	Truck	None	None	W and F
35	Louisville MSD	Jefferson	Louisville									
36	Condea Vista Company	Jefferson	Jeffersontown	234	231	268	285	587	Truck	None	None	M-F
37	Cedar Creek MSD	Jefferson	Louisville									
38	Jeffersontown MSD	Jefferson	Jeffersontown									
39	Glenview MSD	Jefferson	Louisville									
40	Amazing Products	Jefferson	Louisville	700	700	800	900	900	Truck	None	12p-4p, 9a-12p	None
41	Ambrake Corporation	Hardin	Louisville	0	0	0	0	2,565	Truck	M-F	6a-9a, 9a-12p, 12p-4p, 4p-6p	M-F
42	Siemens Electromechanical	Simpson	Franklin	390	400	425	460	503	Truck	None	None	None
43	Technical Products	Jefferson	Shively	1,428	1,495	1,562	1,505	2,270	Truck	M-F	6a-9a, 9a-12p, 12p-4p, 4p-6p	M-F
44	City of Franklin	Simpson	Franklin	0	0	0	12	9	Truck	None	None	F
45	Warner Fertilizer Co.	Warren	Smith's Grove	225	225	225	225	225	Truck	M-S	6a-9a, 9a-12p, 12p-4p	M-S
46	Brown Printing Co.	Simpson	Franklin	8,458	7,212	8,710	8,084	10,854	Truck	M-F	6a-9a, 12p-4p	M-S
47	Dow Corning Corporation	Hardin	Elizabethtown	6,022,988	6,692,220	7,435,800	8,262,000	9,180,000	Truck	M-F	None	M-F